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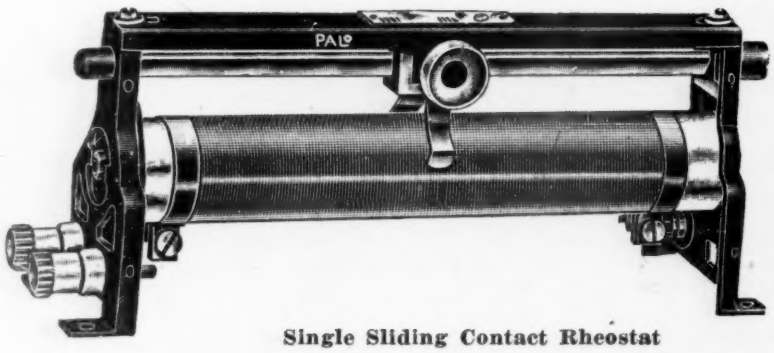

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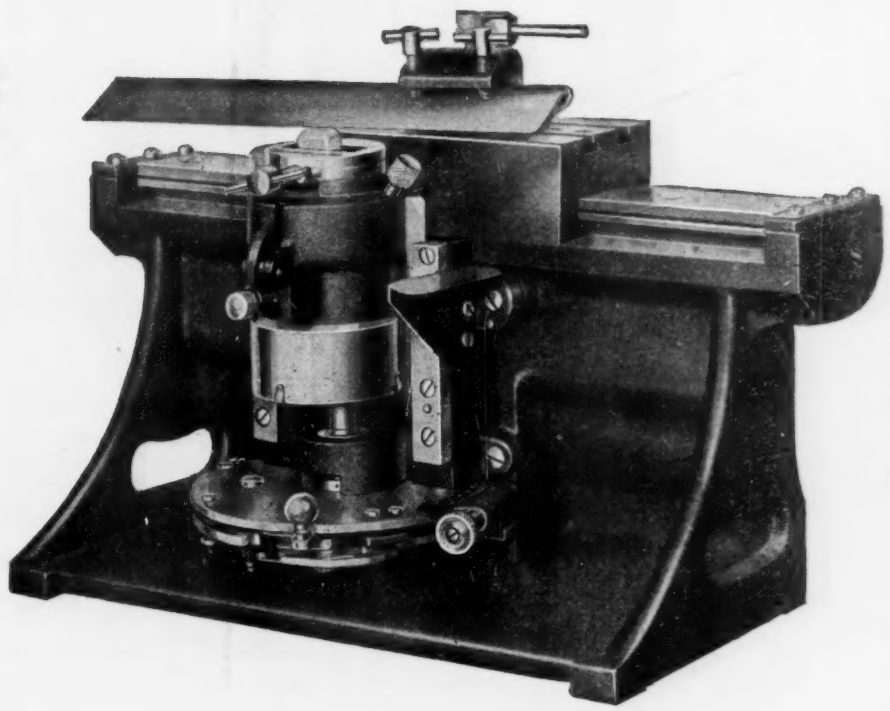

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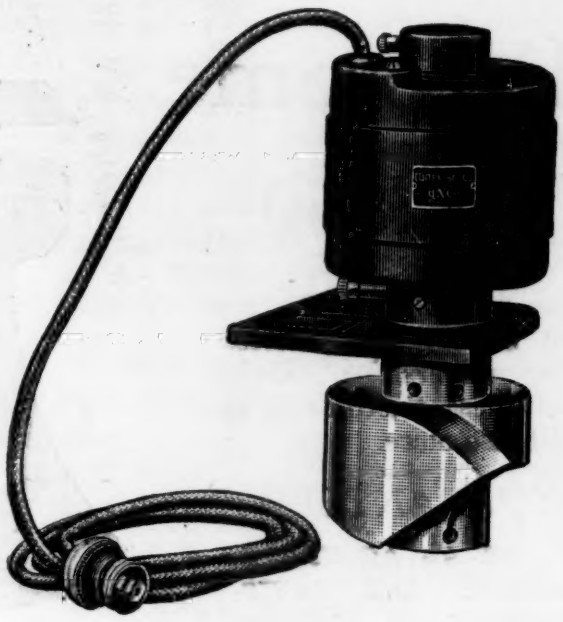

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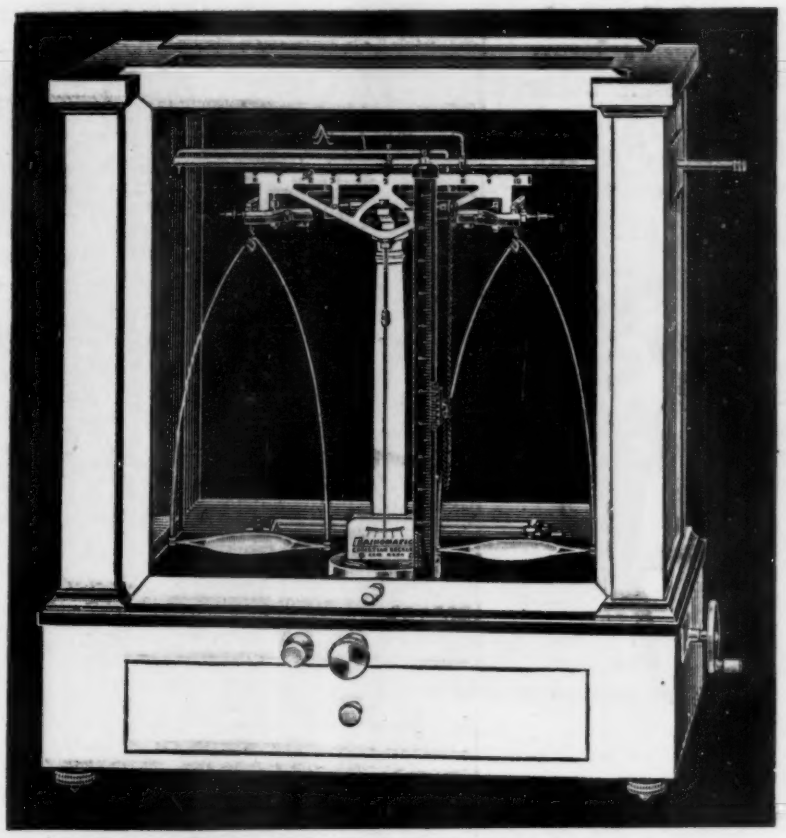

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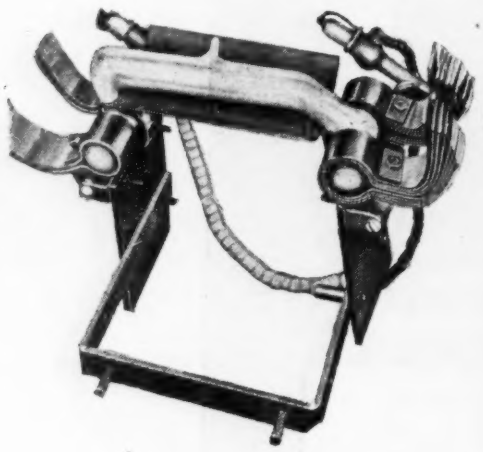

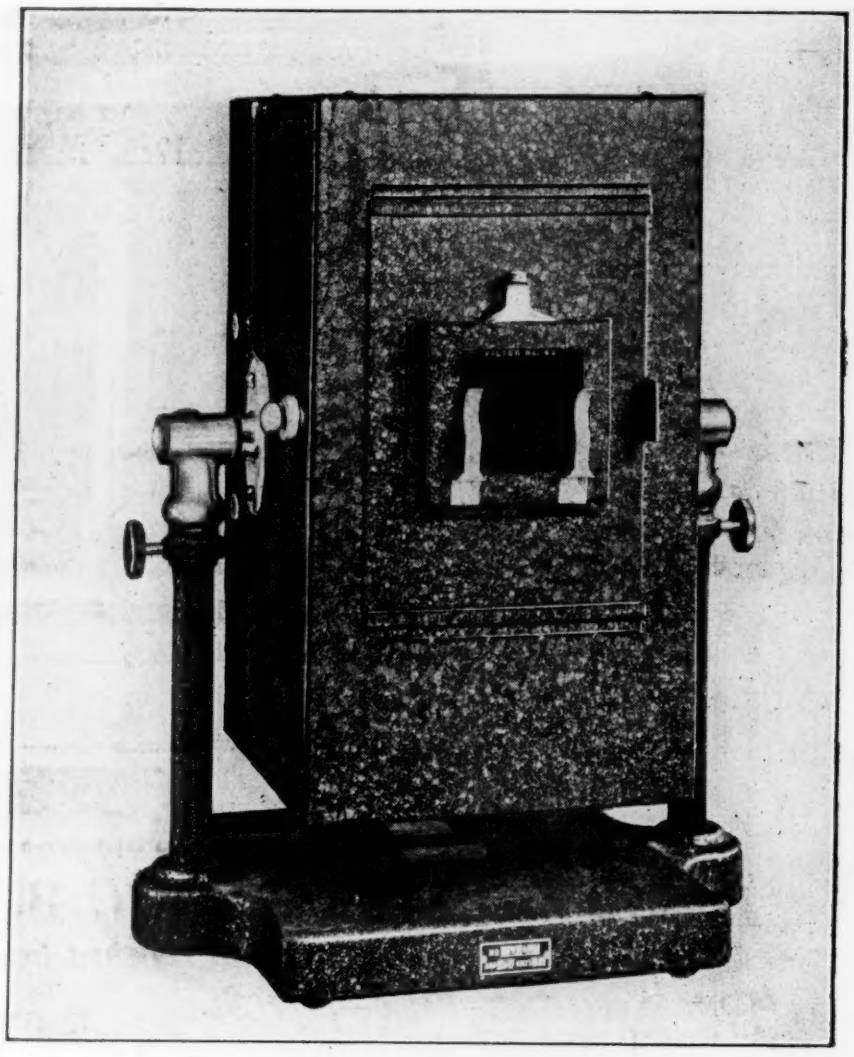

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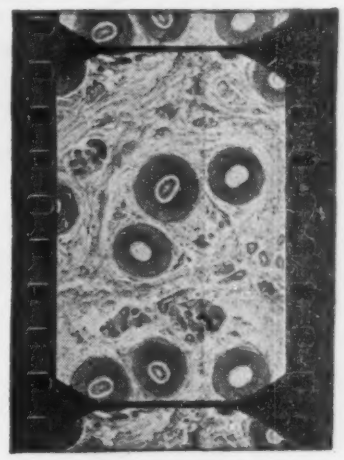

Specimen of image produced with Roll Film Micro Attachment Camera. The characteristics under which this photograph was taken are as follows:

1. Standard type microscope;
2. Achromatic objective 16mm;
3. "Periplan" ocular 8X;
4. Magnification 27X;
5. Low voltage lamp as illuminant;
6. "Lifa" filter No. 200b;
7. Exposure: 1/10 second;
8. Condenser diaphragm closed one-half;
9. Film used: Leitz special cinema film.

Heretofore, the demonstration of microscopical specimens through projection was solely confined to the use of lantern slides. Aside from lantern slides being costly to produce, they are easily broken and represent a bulky collection while transporting them from one lecture room to another. This obstacle is quickly recognized amongst scientists who have to do with lecture work and the reason for an ever-increasing use of film slides (film rolls) for projection is therefore readily conceived. So far, no camera has been available for taking pictures of microscopical specimens upon film slides, and **with the introduction of the Leitz Roll Film Micro Attachment Camera, a long felt demand has been complied with.**

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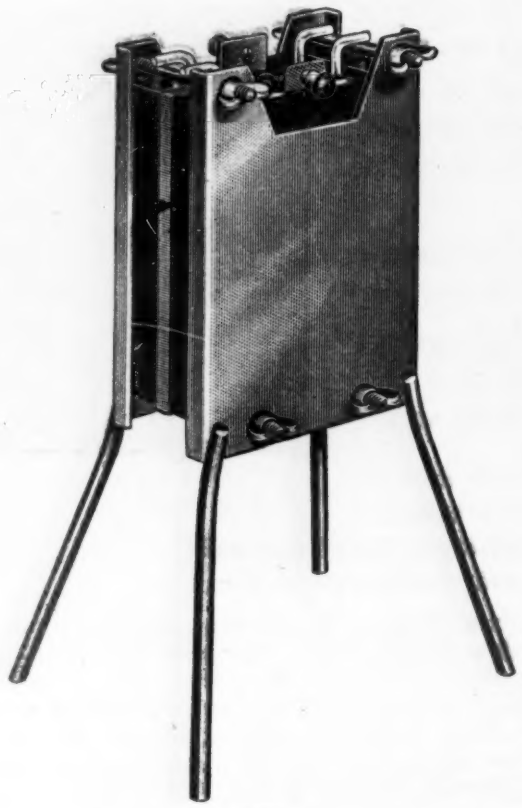

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See Sante Mattson, "Electrodialysis of the Colloidal Soil Material and the Exchangeable Bases," *Journal of Agricultural Research, Vol. 33, No. 6 (Sept. 15, 1926), p. 553;* and Norman A. Clark, H. Humfield and A. O. Alben, "Electrodialysis of Soils and the Mattson Cell," *Soil Science, Vol. XXIV, No. 4 (October, 1927), p. 291.* See also Sante Mattson, "Cataphoresis and the Electrical Neutralization of Colloidal Material," *The Journal of Physical Chemistry, Vol. XXXII, No. 10 (October, 1928), p. 1532;* and H. Humfield and A. O. Alben, "Electrodialysis of Soils, Choice of Electrodes," *Journal of the American Society of Agronomy, Vol. 20, No. 1 (January, 1928), p. 36.*

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PSYCHOLOGY IN AMERICA

ADDRESS OF THE PRESIDENT OF THE NINTH INTERNATIONAL CONGRESS OF PSYCHOLOGY[1]

By J. McKEEN CATTELL

FORMERLY PROFESSOR OF PSYCHOLOGY IN THE UNIVERSITY OF PENNSYLVANIA AND COLUMBIA UNIVERSITY

WE welcome to America the psychologists of the world. You have come from distant nations, but we are intellectual neighbors; your faces may be unfamiliar, but we are scientific friends. Biologically we of the North American continent are descended from every race and people; culturally we owe our civilization in the main to the older nations. We have received a great inheritance; may it be our part to return its fruits with usury. Eight times previously have these congresses of psychology met in six different countries. Americans have enjoyed their hospitality and have profited by their programs. Now the ninth congress has honored us by coming far from its origin and center. In its proceedings we are like Chaucer's clerk of Oxenford:

> And gladly wolde he lerne and gladly teche.

For ourselves and on behalf of our foreign members we have pleasure in expressing appreciation and obligations to the host of this congress, Yale University, long a leader in education and in psychology,

[1] Given at Yale University, New Haven, September 2, 1929. In place of lantern slides there was distributed a brochure of twenty-four pages including (1) portraits of six American and two foreign psychologists—James, Hall, Ladd, Royce, Münsterberg, Titchener, Wundt and Galton, (2) tables and curves showing the number, distribution, work and publications of American psychologists at four different periods and (3) curves showing the results of unpublished experiments made from 1889 to the present time on effort, fatigue, learning and variation in performance.

now forming large plans for the study of human relations.

I

A history of psychology in America prior to the last fifty years would be as short as a book on snakes in Ireland since the time of St. Patrick. In so far as psychologists are concerned, America was then like Heaven, for there was not a damned soul there. Jonathan Edwards, the theologian, and Benjamin Franklin, the practical man, were our most typical representatives. In our colleges mental and moral philosophy was indeed taught, mostly Scotch, the importation of which was not prohibited in those days. Noah Porter, president of Yale University from 1871 to 1886, gave us the most elaborate text-book; James McCosh, president at Princeton from 1866 to 1888, performed the greatest service by sheltering physiological psychology and organic evolution under the cloak of Presbyterian orthodoxy.

There was no science of psychology in America fifty years ago; it may be that there was no organized science of psychology in the world prior to 1879. In that year Wilhelm Wundt established at Leipzig the first laboratory, Th. Ribot published his "La Psychologie allemande contemporaine," Francis Galton his "Psychometric Experiments," William James the first chapter of a work on psychology. In so far as psychology dates from 1879, this congress celebrates the jubilee of our science. The first congress of psychology met in Paris in 1889; the present congress marks the fortieth anniversary of our international cooperation.

The pedigree of psychology, as of every science, can indeed be traced to Aristotle and the efflorescence of the Greek period, further back to the civilizations of Egypt and Asia Minor, dimly through the twilight and darkness hiding primitive men. If the making of fires and the use of tools, the cultivation of plants and the domestication of animals, were the beginnings of the physical and biological sciences, then psychology goes back to primitive speech, habits and customs. Perhaps the origins of psychology may be found in more remote pre-human, pre-mammalian and pre-vertebrate animals than those of any other science. The modern dog doubtless finds more differences between two individuals of its species than between a tree and a lamp-post that smell alike. Our early ancestors were mainly concerned with themselves, with their mates and their offspring, with the behavior of their fellows, of their prey and of their enemies. Satisfaction of desires, escape from danger and pain, efforts to foresee and to control the conduct of others, were the earliest and are the most fundamental of interests.

When such is so clearly the case, it may at first sight seem surprising that the sciences, both curious and useful, of matter and energy should have had an earlier origin and a more systematic development than the biological sciences, while psychology is only now taking its place among the descriptive sciences and has witnessed but its first beginnings as an applied science. The explanation is partly in the difference in stability and complexity of the objects of the different sciences. Matter is plastic to experiment and measurement; human behavior eludes experimental and quantitative methods. The motions of the solar system since its beginning are less complicated than the play of a child for a day. It is also the case that in the architectonics of science the mathematical and physical sciences are fundamental. Morphology and physiology are based on physics and chemistry; psychology on all these sciences. The foundations must be laid before we can build the upper stories, in which we may prefer to live and from which there may be the wider outlook.

A less obvious reason for the late development of psychology is the circumstance that it is easier to satisfy needs and to control behavior by altering the environment than by altering individuals. The savage could learn to shoot an arrow from a bow or to move a stone with a lever more readily than he could strengthen his own right arm. He could obtain food better by planting corn than by developing his skill as a hunter And so it is to-day. By increasing economic production we can do more for the welfare of people than by teaching them to be virtuous and wise. In America we have constructed a great civilization, not by trying to be civilized, but by applying invention and organization to the exploitation of natural resources.

Psychology had to await the development of the exact and the natural sciences, whose objects are more open to measurement, whose contents are more basic, and whose applications are more useful. And it should be remembered that all the sciences, as we now know them, are comparatively new. The doctrine of the conservation of energy is only about as old as Professor Stumpf, the theory of evolution by natural selection about as old as Professor Jastrow. Modern physics and modern genetics are no older than the younger members of this congress. When sciences of earlier origin have made such notable advances during the lifetime of those now living, we may look forward with hopefulness to a corresponding development of psychology within the lifetime of our children.

Fifty years ago William James, born in 1842, was assistant professor of comparative anatomy and physiology at Harvard; Stanley Hall, four years his

junior, was a student in Germany. As to other American psychologists there were—as Franklin said when asked if he had any children—"none to speak of." James was transferred to an assistant professorship of philosophy in 1880 and appointed to a professorship of psychology in 1889, resuming after eight years a chair of philosophy. He published in 1890 "The Principles of Psychology," a work of genius not often equaled in any science or in any language. Hall received the doctorate of philosophy from Harvard in 1878, one of the first awards of the degree, and was appointed lecturer there and at Williams College in 1880. In 1883 he became professor of psychology and pedagogy in the Johns Hopkins University, giving also the courses on philosophy. In that year he established the first American laboratory of psychology, unless we count as such the work by James at Harvard under physiological auspices, in which case it would antedate the Leipzig laboratory.

George Trumbull Ladd, eight days younger than William James, was called to a professorship of philosophy at Yale in 1881; he published in 1887 his "Outlines of Physiological Psychology," the first American book on the subject and, as revised by Professor Woodworth, one of the best. In that year there was established a lectureship and in 1888 a professorship of psychology at the University of Pennsylvania. This chair, held by me, was the first in any university here or abroad to be so named and in which the work of the professor was confined to psychology, the department being coordinate with philosophy and other university disciplines. In the laboratory were given the first experimental courses for students, the work at Leipzig and the Johns Hopkins having been limited to research.

In rapid succession there were then established chairs of psychology and laboratories at Wisconsin under Professor Jastrow, at Indiana under Professor Bryan, at Nebraska under Professor Wolfe, at Brown under Professor Delabarre, at Wellesley under Professor Calkins, at Stanford under Professor Frank Angell, at Clark under Professor Sanford, at the Catholic University under Professor Pace, at Illinois under Professor Krohn, at Toronto and at Princeton under Professor Mark Baldwin. In 1891 a professorship and a laboratory were initiated at Columbia, a year later at Yale, Harvard and Cornell, Professor Münsterberg having been called from Germany to Harvard and Professor Titchener from England to Cornell. In this group should be included, for his contributions to psychology and education, John Dewey, professor of philosophy at Michigan, Minnesota, Chicago and Columbia. Josiah Royce, born in California in 1855, appointed assistant professor of philosophy at Harvard in 1882, a psychologist of distinction, alone bridges the gap between James, Hall and Ladd, our pioneers, and the second generation of American psychologists here in part enumerated.

The academic advance of psychology in America in the course of the four-year period from 1888 to 1892 is notable. There were no foundations as in Germany, England, France and Italy, in which countries a scientific psychology had for a hundred years or more been emerging from philosophy, and in which physics, physiology, zoology, neurology, psychiatry and other sciences had for an equal period been assembling subject-matter and methods that could be taken over by psychology. From our Declaration of Independence in 1776 until the founding of the Johns Hopkins University, exactly one hundred years, but little scientific research was accomplished in the United States and that little remote from psychology. There were Franklin, Rumford, Bache and Henry in physics, the Sillimans in chemistry, Gould and Chauvenet in astronomy, Peirce in mathematics, Torrey, Gray and Engelmann in botany, Agassiz, coming from overseas, Baird and Leidy in zoology, Dana, Hall, Lesley, Le Conte, Hilgard and others in geology, a practical science. But few of them have an international standing; there was none who helped to make straight the way for psychology.

What we had in America prior to 1876 was a comparatively well developed common school system, the beginnings of state universities, many denominational colleges. The research degree of doctor of philosophy was first given in 1861 by Yale. In the course of fifteen years that university conferred 18 of these degrees, Harvard 4, Columbia and Cornell 2 each. After 1876 there was a rapid development of universities and at the same time a large increase in the number of Americans who worked in Germany. Of our leading scientific men in 1903, 487 held the degree of doctor of philosophy or its equivalent. The universities awarding 10 or more of these degrees are: The Johns Hopkins 102, Harvard 57, Columbia 38, Yale 28, Cornell 26, Chicago 25, Clark 12, Michigan 10; in Germany, Leipzig 39, Göttingen 33, Berlin 22, Heidelberg 15, Munich 13. One was from Paris, two master of arts degrees were from Cambridge.

The main condition favorable to the remarkable academic advance of psychology from 1883 to 1900 was the growth of our universities. Previously mental and moral philosophy had in most cases been taught by the president of the institution, qualified for both offices by being a clergyman, and when this situation changed it was natural to continue the teaching of psychology by special students of the subject. The enlargement of the universities and the adoption of the elective system permitted the introduction

of a new science. Our people had curiosity, acquisitiveness and energy, with ever-increasing wealth. We were able to take over what we wanted from abroad; we were not bound by precedents and traditions. Even after years in our environment Professor Münsterberg claimed that "the presuppositions with which a science starts decide for all time the possibilities of its outer extension," and Professor Titchener said that he did not object to work on the measurement of individual differences in behavior so long as it was not called psychology. The psychologist has some reason to thank God when he is born a happy and irresponsible American child.

In comparison with literature and art, science is international. The velocity of light is the same whether measured by Fizeau in France or by Michelson in the United States. The electrons discovered by Thomson and measured by Millikan have the same hypothetical properties in Cambridge and in Chicago. The equations written by Einstein in Berlin are equally correct and equally relevant or irrelevant to the real world in Germany and in Japan. None the less the lines of advance followed by science are directed by the national life. It is not a chance accident that laboratory research in psychology is of German origin, that pathological psychology has been cultivated in France, that psychoanalysis has spread from Vienna, that Darwin and Galton were English, that objective psychology and the measurement of individual differences have had their chief development in the United States. Germany may keep its *Gestalt* psychology, France its hysterics, Austria its libido, England its "g"; we shall continue to bear the burden of our meta-behaviorism.

America is part of the continuation of the cultural history of Europe. In psychology we owe to it everything up to the past fifty years, during which period there has been cooperation on terms that have now become equal. The two Europeans to whom our debt is the greatest are Wilhelm Wundt and Francis Galton. I had the privilege of working with both of them, as also with Herman Lotze and James Ward. Many Americans frequented the Leipzig laboratory, but perhaps only Titchener, who retained his British citizenship and outlook, continued its traditions. Stanley Hall and I were the first of Wundt's American students, but Hall worked in Ludwig's laboratory and I continued in my own rooms the work begun in America, in part because Wundt would not allow the testing in his laboratory of individuals who could not profit by introspection. Galton—the greatest man whom I have known—more nearly laid down the lines for the objective measurement of individual differences. But in his statistical methods of studying individuals he had been preceded by Quetelet and in America by Gould; in his study of imagery by Fechner, this work having been based on fallacious introspection. Wundt and Galton are the foreign psychologists whom we most honor, but it may be that if neither of them had lived psychology in America would be much what it is.

When Jefferson wrote in the Declaration of Independence that all men are created equal, he was referring to the unalienable rights to life, liberty and the pursuit of happiness. Where individual differences in rank and wealth are fixed by custom and law, they are taken as a matter of course. In a political and social democracy, such as has partly obtained in England and to a somewhat greater extent in the United States, attention is directed to the varying qualities of individuals. The wars of England are said to have been won on the playgrounds of its public schools. Competitive fellowships and scholarships, the mathematical tripos, arose in the English universities. The American college student wants to make his fraternity and the football team, sometimes also Phi Beta Kappa or Sigma Xi. Every boy may hope to become a Coolidge and get two dollars a word for his autobiography, or a Carnegie and try to make all university professors his pensioners. He learns that the race is to the swift and the battle to the strong. Those engaged at first in a conflict with nature, wild animals and savages, later in subduing the wilderness, now in the construction of a vast and complicated industrial civilization, are more likely to be interested in their own performance and in the conduct of others than to indulge in the refinements and the vagaries of introspection. It may be that there is American science and American psychology.

Of 84 Nobel prizes in science only five have been awarded in the United States, two of the recipients having been born abroad. No more were deserved. We have not excelled in broad generalizations based on abstract considerations; but we have done more than our share in invention and in the applications of science. It is scarcely necessary to name a few from the long list of advances on which modern life is based which have had their origin or chief development here. Omitting the steamboat, the railway and other applications of steam, these include the cotton gin, the reaper and other agricultural machinery; the sewing machine, the refrigerator, the vacuum cleaner and other household machinery; the typewriter, the manifolder and other office machinery; all sorts of factory, foundry and mining machinery and methods; steel and cement construction; central heating; electric light and electric power; the telegraph, the telephone and the radio; the phonograph and the motion picture; the automobile and the airplane. It may be

that trial and success methods, so important in learning by the individual, are equally fundamental in learning by the race and in the advancement of science. Who devised the Greek temple and the Gothic cathedral? The most magnificent architecture since these is here arising before our own eyes, but no one knows who is responsible for it. The proximate cause of the New York sky-scraper is an ordinance of a board of aldermen, prescribing that, in order to conserve light, high buildings must be recessed from the street.

The situation is the same in psychology. The advances in America are due to the work of uncounted individuals, many of them not known as psychologists. It appears that I was the first to publish psychological measurements of individual differences without regard to introspection and with special reference to their useful applications, but that is because I had the misfortune to be born a long time ago. So Columbia University and its Teachers College may have done the most—more than 150 members and associates of the American Psychological Association hold its doctorate—to advance objective, individual and group psychology, especially in its applications to education. In a sense this is due to Professor Thorndike, Professor Woodworth and other leaders who have worked with me, but it is in the main a manifestation of economic and other factors of our national life. Psychologists have been academic teachers and have naturally taken up problems concerned with children and schools. Other aspects of objective psychology to which these lead have been measurements of animal behavior. We are apparently somewhat behind Germany in the applications of psychology to industry, but we have a large development of industrial management and personnel work—the Taylor system is American—which will ultimately be taken over by official psychology. Even our swarms of cranks in the air above and our shoals of charlatans in the water beneath may be found to have contributed their bit, when natural selection and survival of the fit are given ample time.

It is not intended to discuss here the relative extent to which progress is due on the one side to great leaders, on the other to the activities of large numbers of individuals reacting to economic and other conditions. Neither is there any intention to undertake to define or delimit the field of psychology. Over a long period of years I have expressed opinions, incidentally or when an official address was required, some of which are quoted in the brochure that has been distributed; but such dicta—as also those that I am now perforce imposing upon you—are more analogous to a parlor game than to scientific research. The work at hand must be done; time will tell what part of it is useful and will survive. We can, as they say, "point with patriotic pride" to James, Hall, Royce, Dewey and Santayana as five writers on psychology, approaching it from the philosophical and literary side, but with full appreciation of scientific method, such as would be difficult to parallel in any other country. It seems, however, that the chief contribution of America to psychology has not been large philosophical generalizations, but the gradual accumulation from all sides of facts and methods that will ultimately create a science, both descriptive and applied, of human nature and human behavior. Each of us, as the English poet Clough says,

> must slave, a meager coral-worm,
> To build beneath the tide with excrement
> What one day will be island, or be reef,
> And will feed men, or wreck them.

II

The American Psychological Association was founded in 1892 on the initiative of Stanley Hall with 31 members; it now has 540 members and 353 associates; next year the total membership will be about 1,100. It is under the auspices of our association, which covers the whole of North America, that this congress is held. The officers and the national committee of the congress were elected by a plebiscite vote of the membership of the association, which has appropriated funds for the expenses and will publish the proceedings. It has merged its annual meeting with the congress and the address of its president will be one of our principal functions. It owns—thanks to the generosity of Professor Warren—and conducts six psychological publications; at the last annual meeting in New York the registration of attendance was over 500. The association may not be as useful as it should be and will be, but it is one of the most responsible American unions of scientific men and the world's greatest organization of psychologists. The growth of the association, which closely parallels the increase in the number of American psychologists, is recorded in the table and shown in the curve which are printed in the brochure that has been placed in your hands.

The 31 members of the American Psychological Association in 1892 exhibit the position of psychology in America 37 years ago. The majority were not primarily psychologists. It may be that only four or five of the number were then actively engaged in psychological research and so continued. Of the presidents of the association for the first sixteen years perhaps only Jastrow has remained faithful. During this period psychology was entangled with philosophy and parasitic on other sciences. Of the nineteen presidents of the association since 1910, all but two are

now actively engaged in psychological work, one of the two exceptions, Baird, having been so occupied at the time of his death.

In 1903 a census was taken of the psychologists of the United States. There were 313 who were judged to have contributed to the advancement of psychology, or, excluding those whose work was not primarily in psychology or in psychology combined with philosophy or education, there were 270. In that year the Psychological Association had 135 members. The number of psychologists had about quadrupled in eleven years. A study was at that time made of their origin, work and standing for the number of the *American Journal of Psychology* issued in honor of Stanley Hall.

In psychology and in each of eleven other sciences the workers were arranged by ten of their leading colleagues in the order of the value of their work and the average positions determined. This order of merit method is an American contribution that has found wide application in educational psychology and in other directions. Philosophers are still included among the fifty leading psychologists, and as many as seven were or became university presidents; but in eleven years there had been a remarkable increase in the number of those professionally engaged in psychological work.

When scientific men were arranged in 1903 in order of merit it was stated that the lists would not be published within 20 years. Twenty-six years having now elapsed it may be useful in a historical survey to name the psychologists. The order gives no information concerning their contemporary position, several near the bottom having risen to the top and some at the top having dropped. A comparison of the standing of each psychologist after a period of twenty years has been made. This gives in quantitative units (with a probable error attached) his gain or loss in the judgment of his colleagues. The efforts of a lifetime are condensed into a single informing and dramatic figure. On the list in the brochure there is given the rank, which is the average position obtained from ten judgments, followed by its probable error.

The 200 competent psychologists of 1903 received their college degrees from 76 different institutions. The students then gathered in a small number of universities for graduate work; of 115 American doctorates 23 were conferred by Columbia, 22 by Cornell, 18 by Clark, 15 by Harvard and 11 by Yale; of 31 German doctorates 17 were from Leipzig. Practically all our psychologists were at that time engaged in teaching. Their relative productivity was found by counting the articles printed in or reviewed by the *Zeitschrift für Psychologie* in its first 25 volumes. Germany was far in the lead, partly owing to the source of the data. The number of experimental contributions from Germany, France and America was about the same. In theoretical papers we were about equal to England and far behind Germany and France; in physiological and pathological papers we were exceeded tenfold by Germany, threefold by Italy, France and England.

A further study of the distribution of American psychologists was made at the end of the year 1916 for an address given on the occasion of the twenty-fifth anniversary of the American Psychological Association. The members then numbered 307; more than 90 per cent. of all psychologists of standing were found to be included. The psychologists of America had about doubled in number from 1903 to 1916, whereas they had about quadrupled from 1892 to 1903. Of the 307 members 272 were engaged in educational work in 121 different institutions. 16 were connected with boards of education, hospitals, charitable institutions, etc., and it was at the time remarked that "this group, now so small, may at our fiftieth anniversary surpass in numbers those engaged in teaching." 84 per cent. of the number held the degree of doctor of philosophy, making psychologists the most academic of scientific workers, mathematicians and zoologists coming next with about 60 per cent. The American universities which conferred more than two of the 258 degrees were: Columbia 46, Harvard and Chicago 31, Clark 25, Cornell 24, Johns Hopkins and Yale 15, Pennsylvania 11, Iowa 6 and Michigan 4. The foreign universities were: Leipzig 15, Würzburg, Berlin and Freiburg 3.

The papers presented at the first 25 meetings of the association were classified by five-year periods. The percentage of experimental papers fell from 1892 to 1902; afterwards it increased slightly. The significant features of the curves are the great decrease in historical, philosophical, analytical and introspective papers, and the great increase in papers concerned with the measurement of individual differences in behavior. The time that psychologists reported themselves able to devote to research was found. Only 16 of the 215 who supplied the information devoted more than half their time to research; 149 of them less than a quarter. They are placed in three groups, in accordance with the value of their work. The largest group, ominously large, consists of those doing little or no research and standing lowest. Otherwise, there is scarcely any correlation between ability in research and time devoted to it.

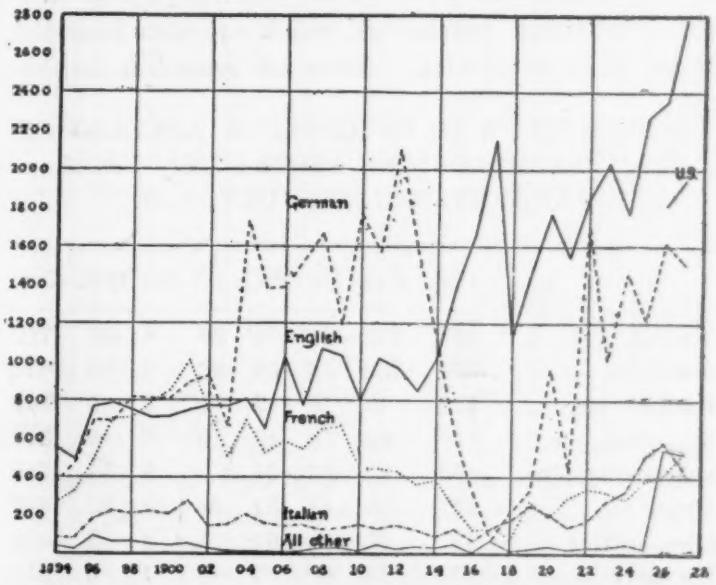
In the twelve years since the celebration of the twenty-fifth anniversary of our association, it has grown from 307 members to 540 members and 353 associates, all of whom are or have been engaged in psychological work. Of the members only 12 do not

have the degree of doctor of philosophy or its equivalent. The universities that have conferred the largest numbers of these degrees are Columbia 155, Chicago 91, Harvard 68, Clark 54, Iowa 42, Pennsylvania 41, Cornell 37, Johns Hopkins 34, Stanford and Yale 26, Washington and Minnesota 15. There are only four degrees from Leipzig, whereas there were 17 in 1903, with one fourth as many psychologists. The institutions from which the first degree was received are widely scattered and there seems to be no tendency for psychologists to be recruited from the institutions having strong graduate departments. I have found the center of productivity of scientific men to have moved westward from New England to the central states and onward to Iowa, Missouri and Nebraska. In the production of psychologists the universities of Indiana and Nebraska stand high.

The 893 psychologists hold positions in 339 different educational and other institutions. There are no fewer than 45 at Columbia, of whom 34 are members and 11 associates; Minnesota ranks next with 24, followed by Harvard, Pennsylvania, Yale, Chicago, Cornell, Stanford, Iowa, Ohio State, Michigan, New York and the Johns Hopkins, which are the institutions with which 10 or more psychologists are connected. In the two divisions of the University of California there are 17. The budgets of these universities show that, in spite of inadequate salaries, large sums are now spent on psychological teaching and research. Columbia appropriates nearly $200,000 annually for psychology, the budget of the university corporation being $69,200, of Teachers College $107,266, of Barnard College $18,800. Among the universities reporting, Ohio State stands next with costs of $114,771, followed by Stanford, Northwestern, Minnesota, Chicago, Michigan and Indiana, which are the universities having budgets in excess of $40,000. Seven institutions spend on psychology between $30,000 and $40,000, sixteen between $20,000 and $30,000, thirty-five between $10,000 and $20,000.

A table has been drawn up from the reports made by members of the association on the subjects that they are teaching and the subjects with which they are engaged in research. Two or more subjects are usually given and the relevant fraction of the total time is distributed to each subject. Apart from "general" which refers mainly to teaching, "experimental" stands first, occupying the full time of the equivalent of 116.5 psychologists. "Educational," representing the time of 109.5 individuals, comes next, followed by "tests" and "clinical," 77.5 and 73.5, respectively. There then follow in decreasing order pathological, social, genetic, applied, theoretical, vocational, comparative, physiological, statistical and historical. The classes overlap, but the times are distributed among them as well as may be in accordance with the reports of those concerned. It is evident that the time of American psychologists is mainly devoted to work on individual differences by objective methods, educational work predominating. Curiously only one half of a psychologist confesses to the pursuit of psychoanalysis.

Professor Fernberger has counted up the publications recorded in the *Psychological Index* from 1894 to 1925 in accordance with the language used. For 1926 and 1927 the count has been continued, contributions from the United States and from Great Britain being separated. The curves are truly dramatic. For the first nine years at the end of the last century and the beginning of this, English, German and French contributions were very nearly equal in number, rising for each language from about 400 to about 800. There is then a remarkable increase in the German publications up to over 2,000 just before the war. The French publications drop to an average of about 400. The English publications remain nearly constant with a small increase. The disaster of war practically eliminated German and French publications. Owing to America, contributions in English rise with a drop for 1918. Germany has now regained its pre-war level, but French publications are fewer than 30 years ago.



CONTRIBUTIONS TO PSYCHOLOGY RECORDED IN "THE PSYCHOLOGICAL INDEX"

The titles from 1894 to 1925 were compiled and published by Professor Samuel W. Fernberger. For 1926 and 1927 the contributions from the United States are given separately. The classification is based on the language of the publication rather than on the nationality of the author. In order to conserve space the size of the curves and lettering is here reduced further than otherwise would be desirable.

France, Italy and Russia are close together, each with about 500 publications. The number of Russian contributions is notable. It should be remembered that variations in the curves are due to methods of indexing as well as to actual variation in the number of publications in a given year.

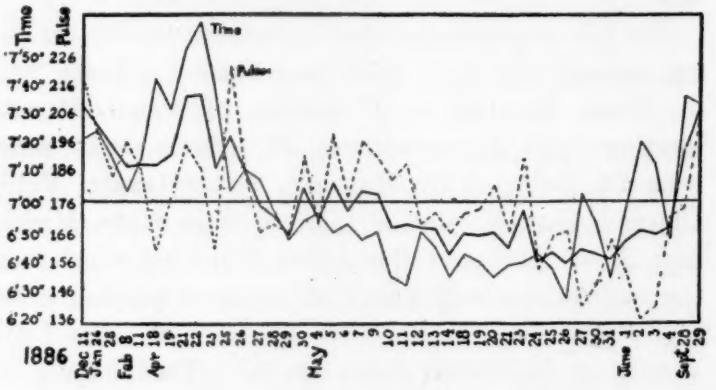
For publications in the year 1927 (including a few from the preceding year) I have made a subject as well as a language classification and have used also the German indices. In that year the distribution of titles according to the *Psychological Index* was: United States, 1,943, German, 1,509, British, 836, French, 553, Russian, 457, Italian, 449, all other, 71. The correspondence with the German indices is so close that I assume there is an exchange of titles such as I arranged when responsible for the American index. The distribution is as follows: United States, 1,966, German, 1,353, British, 775, French, 519, Russian, 480, Italian, 461, all other, 84. The total number of psychological publications recorded in our index is 5,798, in the German indices, 5,638.

In the subject-matter classification used in both the American and German publications what is called "mental development" stands first with 1,108 and 1,142 publications, respectively, recorded. Then follow "psychopathology" with 919 and 892, and "social functions" with 928 and 870. "Mental development" and "social functions" are not satisfactory terms; the publications refer largely to tests and educational psychology which are also included under other categories. There are recorded, respectively, 489 and 449 publications on sensation and perception, only 70 and 73 on feeling and emotion. The United States leads Germany in educational and comparative psychology; it is below Germany in psychopathology and "special (largely abnormal) conditions." We are also relatively below England and France in those subjects as in physiological psychology.

CONTRIBUTIONS TO PSYCHOLOGY ABSTRACTED IN "PSYCHOLOGICAL ABSTRACTS" FROM JANUARY, 1927, TO JULY, 1929

	U.S.	Ger.	Br.	Fr.	It.	Ru.	Oth.	Tot.
General	483	113	66	64	28	8	28	790
Sensation	329	162	55	68	22	2	35	673
Feeling, etc.	112	10	8	7	2	1	9	149
Attention, etc.	178	49	19	42	10	3	8	309
Nervous System	92	63	36	34	5	9	11	250
Motor	317	144	48	51	26	23	37	646
Comparative	317	67	30	64	1	4	12	495
Heredity	235	17	60	7	6	1	6	332
Special	286	258	147	95	20	9	31	846
Pathological	513	199	147	203	57	54	37	1,210
Individual	741	223	68	63	18	4	57	1,174
Industrial	274	85	56	27	6	11	18	474
Childhood	363	78	27	32	12	16	36	564
Educational	797	53	28	34	2	4	33	951
Statistics	107	5	11	2	1	0	2	128
Tests	308	23	30	18	2	0	11	392
Total	5,449	1,549	836	811	218	149	371	9,383

A table is also presented showing a classification of the contributions to psychology abstracted in *Psychological Abstracts* from its first issue in January, 1927, to the current issues for July, 1929. These number 9,383, approaching the number of titles recorded in the *Psychological Index*. The United States is in the lead with more publications abstracted than are listed by title in the index.



PRACTICE CURVES FOR RUNNING THREE MILES IN 1886 AND 1887

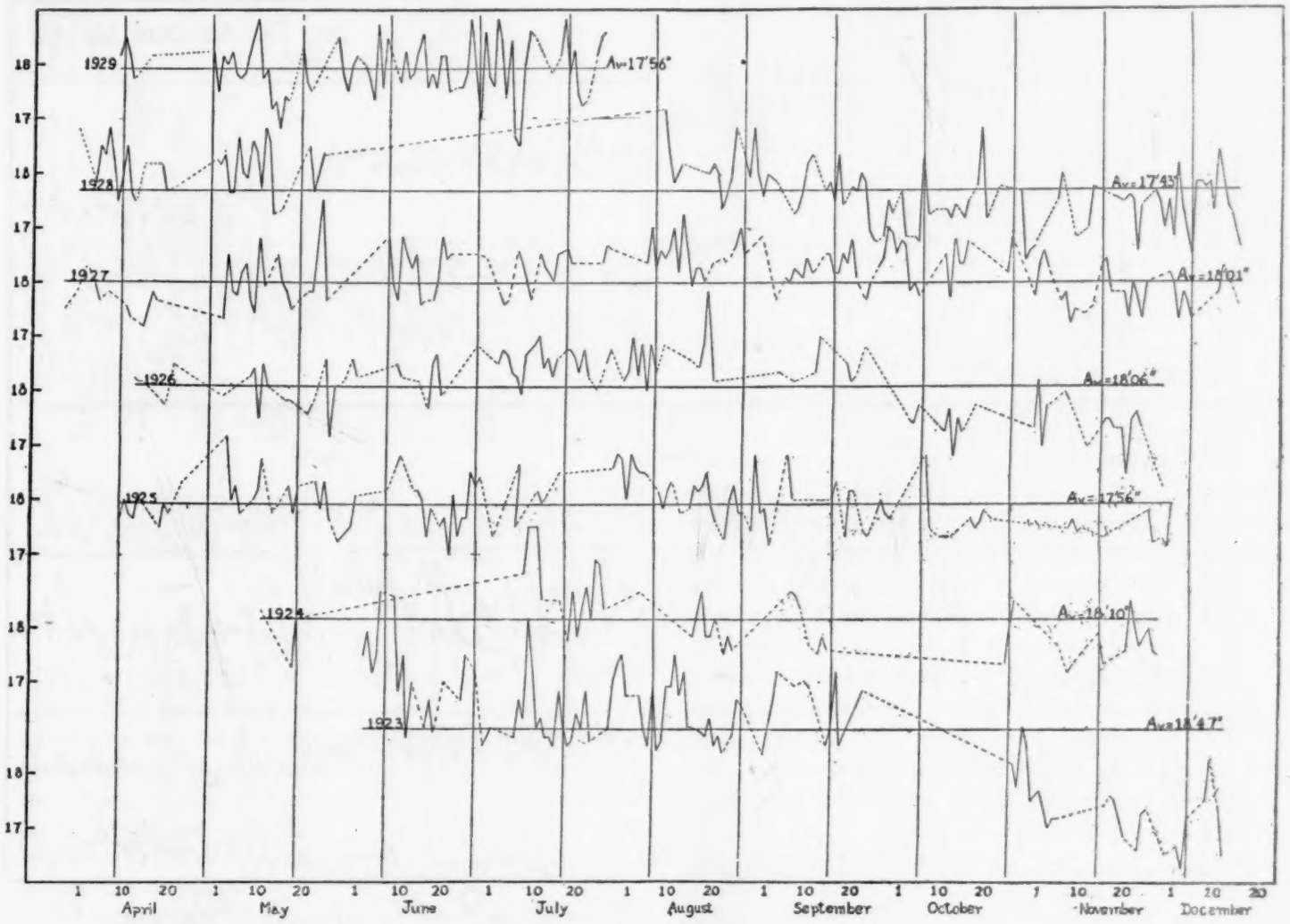
These curves, hitherto unpublished, appear to be the first practice curves and the first quantitative study of the relations between fatigue and effort on the one side and physical and psychological conditions on the other. The experiments were begun at Leipzig in the spring of 1886, the records here given having been obtained at Cambridge, England, at the end of 1886 and in 1887. There are other records for running a single mile. The figures give the average time for each of three miles and the average pulse rate at the end of each. As shown on the curves the variability in seconds and in pulse beats happened to be the same, so an average gives a significant practice curve and measure of performance, for if other things are equal the shorter the time the higher the pulse.

It may be noted that there was greater irregularity at first, especially in the relation of the time and pulse. Afterwards there is a definite improvement in each with the variations shown in the curves. The last two trials after an interruption of three months show both a longer time and a more rapid pulse.

Full records were kept of physical and emotional conditions, occupation during the day, hours slept the night before, coffee, tobacco and alcohol used, weather, etc. Correlations are not here given for, though it may be that no similar experiments have been made in the course of the past forty-three years, the curves are intended to be regarded mainly as museum specimens.

These number 5,449, followed by German 1,549, British 836, French 811, Italian 218, Russian 149, other 371. That more than half of the 9,383 publications are American is doubtless due to the place of publication of the abstracts, but this will probably soon be the actual situation. The classification of titles is more satisfactory than in the case of the indices. Of 951 publications in educational psychology we are responsible for 797, with nearly the same predominance in tests and statistics as also in comparative, genetic and industrial psychology. In physiological and pathological psychology we are relatively much below Germany, England and France. The publications for 1927 abstracted or reviewed in *l'Année psychologique* have also been collated. The 1,166 publications are distributed as follows: American 371, French 365, German 249, British 83, Italian 40, Russian 21, other 37.

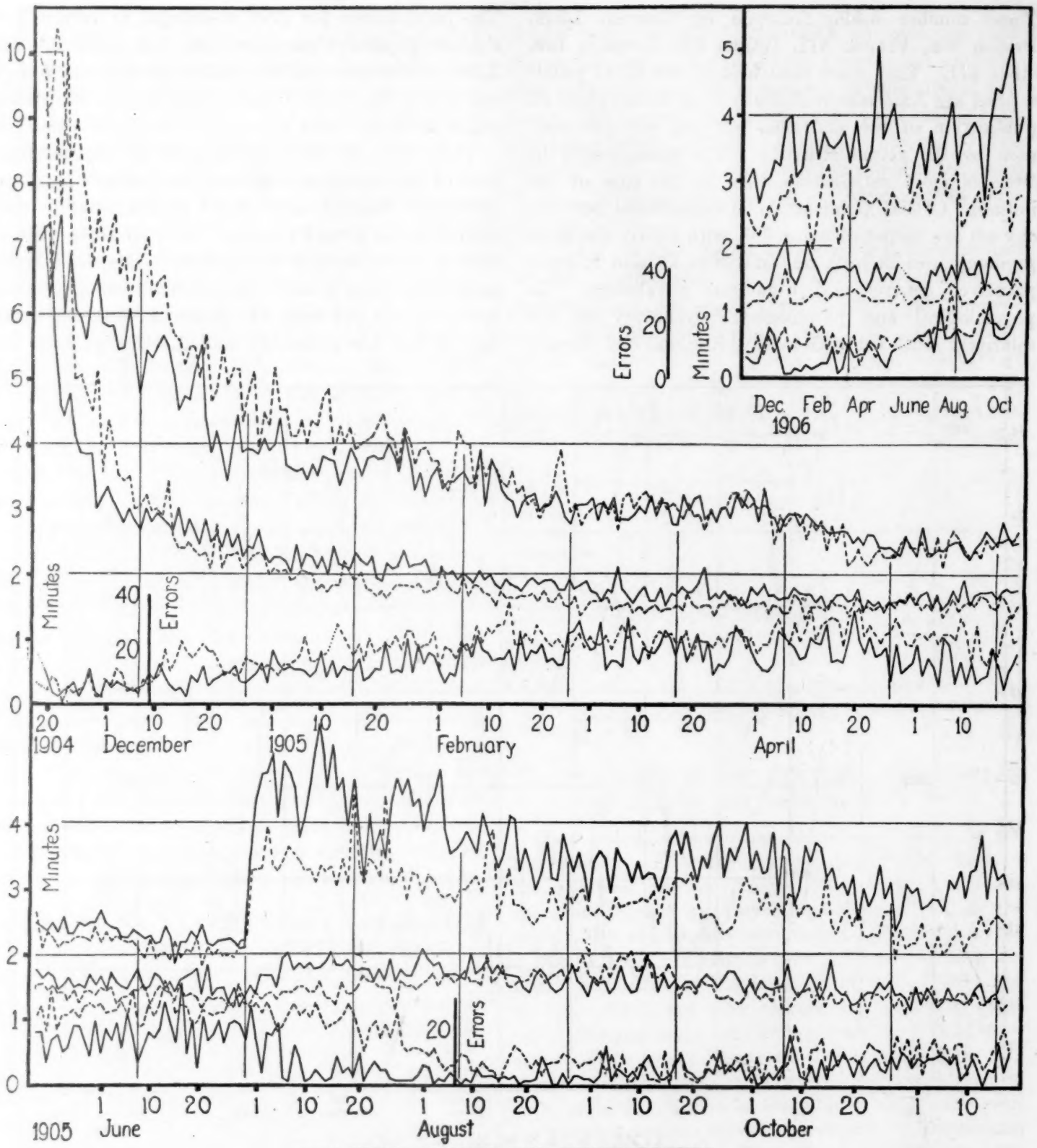
There were no women among the 31 original members of the American Psychological Association; two, Professor Calkins and Mrs. Ladd-Franklin, were elected at the second meeting. In 1917 there were 39 women, 13 per cent. of the number. This was a larger proportion than in any other science, zoology coming next with 7.5 per cent., the percentages then decreasing to 2.1 for chemistry and 1.3 for physics and



TIMES FOR WALKING A MILE

The times are shown in the curves for walking about a mile, including a descent and ascent of about 300 feet. The data are from the same individual who made the records for running forty years before. The pulse was also taken here and a record of physical and psychological condition, weather, etc., and there was made an estimate of time and pulse rate before the performance was known. All records, 729 in number, are given, though it appears that an error of a minute may have occurred in several cases, the time of starting not having been recorded. The times are regular, the average variation in 1929 being 23 seconds. Days for which there was no record are indicated by a broken line. These were in most instances due to absence from home, the subject, for example, having been in Europe in the summer of 1928.

It is not proposed to give here a scientific analysis of the data. Attention may, however, be called to the value to the individual of such records. They make a brisk walk before breakfast a matter of interest instead of a task. They have a considerable diagnostic value, especially when made with advancing years. In the curves shown the times are longer and more irregular the first two years than the last four. This is partly a practice effect, though the intervening winters would prevent improvement through better physical condition from the exercise. The physical and psychological age in later life deserves thorough investigation, for it is a problem of great practical importance.



PRACTICE CURVES FOR TYPEWRITING

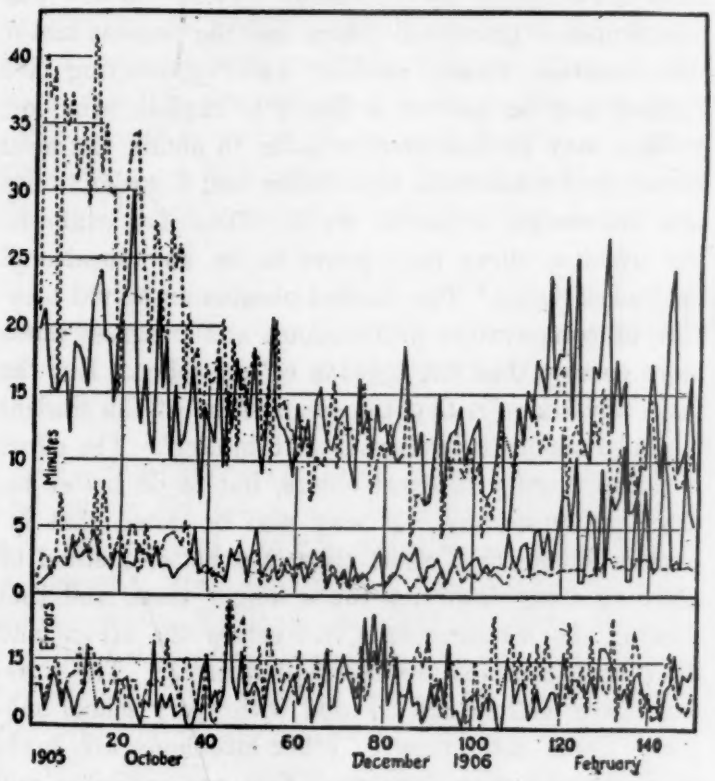
The curves are for practice in typewriting made on 365 consecutive days without an exception and continued once a week for a second year. The solid line is for a girl, the broken line for a boy, whose ages at the beginning were 13 and 11 years. The material used was the first stanza (74 words in archaic spelling) of Spenser's "Fairy Queen" repeated over and over and three new stanzas each day. To make the times for the repeated and the new material comparable the latter has been divided by three, though this reduces the relative variability. On June 29, where there is a rise in the curve, a page of George Eliot's "Mill on the Floss" was substituted for the three stanzas of the "Fairy Queen," the times being divided by four to correspond with the number of words. The ordinates showing the number of errors are for the repeated stanza.

These curves have not hitherto been printed though they have been used by Professor M. A. Rosanoff to study the relation of the practice curve to physical and biological formulas and by Professor Ellsworth Huntington to study the relation between performance and the weather. The curves are dramatic exhibits useful for obtaining a comprehensive view of the results; correlations must be calculated from the original figures.

In the course of these measurements there were made once a month tests of 10 different sensory-motor processes, ranging from tapping to cancelling A's, in order to investigate the transfer of practice.

geology. There are now 242 women who are members or associates of the association, 27 per cent. of the total membership. In but few fields of endeavor in which men were in complete control thirty-seven years ago have women made such large gains.

Contrary to the usage of most foreign academies, our National Academy of Sciences, though it does not at present have members in economics, history or philology, includes psychology among the natural and exact sciences and has a section of anthropology and psychology. The National Research Council, which is a committee of the National Academy, has likewise a division of anthropology and psychology. The American Association for the Advancement of Science has a section of psychology; its section of education is largely concerned with psychological measurements. Reference should be made in passing to the organization of psychologists during the war by a committee of the American Psychological Association, the National Research Council of the National Academy and

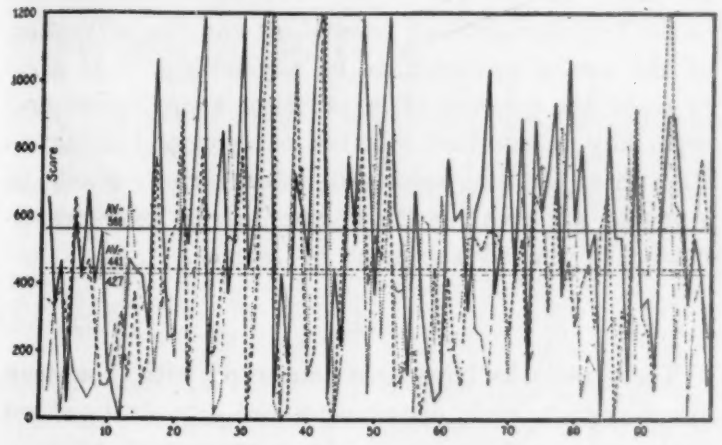


CURVES FOR LEARNING GERMAN WORDS

The upper curves show the time required by a girl of fifteen (the solid line) and a boy of thirteen for committing to memory ten German words and their English equivalents. The German words were the more commonly used words of one and two syllables not having similar forms in the two languages. It was difficult to find so many words; if they are known it is comparatively easy to read the language.

The middle pair of curves shows the time for relearning the same ten German words and their English equivalents on the following day. Records were kept of the time required to call to mind and write down the twenty words, but the data are not given here; it is mainly a matter of time consumed in writing. The numbers of errors for the first learning, mostly of spelling, are shown in the bottom pair of curves. There were later made experiments in which it was not required that the twenty words be committed to memory, but the German words being given the English equivalents were written after them and conversely.

Parallel with the measurements experiments were made on the transfer of learning. Once a month nine different kinds of material were used, French and Latin words, concrete and abstract prose and verse, etc.



SCORES AT BRIDGE

There are shown on the curves scores at bridge. Scores at chess, tennis and billiards made by the same individual are not here shown. The results at bridge are for 100 consecutive rubbers of three-handed bridge by the same players in the course of four years. The mean variation for the middle score of 441 is 236; the probable error for the 100 rubbers is 20. The larger score of the upper curve is consequently due to greater skill, whereas the smaller score of the lower curve is likely to be due to chance.

The curves for chess and tennis show with each ordinate the number of games won by an individual in a group of ten. The chess games were played with the same opponent over a period of five years to the present time, the tennis games in 1928 and 1929. The curve for billiards gives the number of points made in 100 shots. The records cover a period of four years to the present time.

None of the curves shows improvement with practice or deterioration, though it might be that in chess and tennis both players improved. The changes with age in sedentary games such as chess and cards, in games requiring motor coordination such as billiards, and in games requiring physical activity such as tennis, are of obvious interest.

It is curious that in spite of the millions of people who daily play these four games there does not appear to have been made any scientific investigation of the effects of practice or of variability in performance and its causes. No attempt at such a study will be made here, but attention may be called to the circumstance that continuous scores and curves add to the interest and pleasure of games. If a game is interesting in itself gambling is superfluous.

the American Association for the Advancement of Science under the leadership especially of Colonel Scott and Lieutenant-Colonel Yerkes. Most American psychologists became commissioned officers of the sanitary corps and took an active part in applying psychological methods. In a review of psychological organization mention should be made of the Psychological Corporation chartered in 1921 with 20 leading psychologists as directors and 170 members of the American Psychological Association as stockholders. The objects of the corporation are defined as the "advancement of psychology and the promotion of the useful applications of psychology." It aims to make the practice of psychology a profession and especially to conduct research of economic value on the lines of the industrial laboratories, which in America are rivaling the universities in their contribution to the advancement of science.

III

These remarks have been concerned with American psychologists, their distribution and organization, not with our contribution to the advancement of psychology, the briefest summary of which would require manyfold the time at my disposal. What we are doing in psychological research will be shown by the 360 papers and reports to be presented by American psychologists before this congress. In a formal address before a scientific congress it may, however, be expected that the speaker will give some account of his own work. Perhaps the data concerning American psychologists may be regarded as such, for one of the developments of psychology in America has been the statistical study of groups of individuals. The main contribution of America to psychology has been the objective measurement of response to the situation without introspection and with special reference to individual differences and practical usefulness. It happens that experiments on effort, fatigue, learning and variation in performance, begun in 1886 and continued to the present time, have not been published, so reference may be made to them here as an example of the kind of work that I have tried to do.

Limits of time allow only a few words in regard to the raw data exhibited by the curves in the booklet that you hold. Perhaps this is not unfortunate, for it is a practical demonstration of the scientific method that I have followed. Theories assumed to explain the way people learn may be more interesting than crude facts, but theories are likely to become beds of Procrustes into which observations are fitted. Certainly we want laws in psychology; it would be most convenient if every one learned everything in the same way and this could be stated in a simple equation. But we are concerned with the real world in which we live; it is not the scientific man but the philosopher who hopes to see from his armchair a vision of monism seated in the lap of the absolute.

Perhaps a useful classification of individuals would be into those who ask "why" and those who ask "how and what for." Why people learn in the way they do is one question; how people learn, how they differ in the way they learn and what are the best ways to learn are different questions: these are the ones with which I am concerned. Acquired reflexes, so fruitfully investigated by Professor Pavlov—to-day our distinguished guest—of which on the sensori-motor side reaction times, reading and typewriting are typical, may be used as a theory to explain behavior, or they may be measured in order to obtain the most correct and economical description and in order to use this knowledge in useful ways. Thus, for example, the practice curve may prove to be an educational method of value. The student obtains an actual measure of comparative performance and progress much more correct than the opinion of a teacher. But the main advantage is that the competition of the student is not so much with others as with himself. The effort is not primarily to excel others, but to do better to-day than yesterday. It may also be noted that intensive effort for a short time is a better method of learning than dawdling for a longer time, and that making the measurements, correcting the errors and drawing the curves are excellent training. The practice curve method can be used with every school subject. Some references to other problems are made in connection with the curves that are exhibited and it is necessary to stop at that.

IV

International congresses are significant factors in the advancement of scientific research; they also promote international cooperation and good-will. The objects of the sciences are more ideal than the objects of the churches; their practices are more Christian. When in the fulness of time there is a family of the nations, when each will give according to its ability and receive according to its needs, when war among them will be as absurd as it would now be for members of this congress to begin murdering one another, this will be due in no small measure to cooperation among scientific men of all nations in their common work. And it may be that psychology, the child among the sciences, and the United States, the child among the nations, shall lead them.

It is the object of psychology to describe, to understand and to control human conduct. The old philosophical distinctions between a positive and a normative science have faded in the light of increasing knowledge and common sense. If any one here holds that

war is a blessing, it is not a matter for argument, but a case for confinement in a hospital for the insane. Within limits we know what we want and can use the methods of science to get it. Psychology, not less than other sciences, perhaps more than any one of them, is concerned with problems of human welfare. The nation, the family, schools, churches, courts, prisons, armies, navies—these are all institutions which aim by emotional and rule of thumb methods to alter individuals and to control their behavior. When we have knowledge and understanding concerning institutions and individuals and learn how to apply knowledge and understanding for their betterment, it will be the product of a science of psychology.

There may be worse ills on earth than wars, a more desirable good than friendship among the peoples of the world; but an international gathering is particularly concerned with these things. The Seventh International Congress of Psychology held at Oxford in 1923 was the first scientific congress after the war to which all nationals were invited on equal terms; we welcome to the present congress with special pleasure psychologists from Soviet Russia. The United States has taken a Quaker engineer for its president; we have set up a symbol of peace and scientific progress in an industrial democracy. In the words given by our great poet to Columbus for his prayer to God, as "full of woe . . . a batter'd, wreck'd old man . . . he took his way along the island's edge":

> Haply the swords I know may there indeed be turn'd to reaping tools,
> Haply the lifeless cross I know, Europe's dead cross, may bud and blossom there.

OBITUARY

GEORGE RUSBY KAYE

1866–1929

GEORGE RUSBY KAYE, until recently a member of the Indian Education Department at Simla, India, and well known for his memoirs on early Hindu mathematics, died suddenly of heart failure at Tunbridge Wells, England, on July 1, 1929. He was born at Leicester on November 9, 1866, and most of his active life was spent in India. He was for a time vice-principal of the Allahabad Training College, and in 1904 became bureau assistant to the director-general of education. In 1910 he became registrar of the Education Department and in 1915 was appointed curator of the Bureau of Education. He also held the post of secretary to the Central Advisory Board on Education, and in recognition of his work in the educational field he was awarded the Kaisar-i-Hind gold medal in 1921. He retired from the Indian service in 1923, but was soon thereafter appointed to carry on the cataloguing of manuscripts in European languages in the India Office Library, London.

It was, however, for his work in the history of Hindu mathematics and astronomy that he will best be known. He was a careful student of the Sanskrit classics in this field, and among his memoirs were "Indian Mathematics," a historical sketch (1915), "The Astronomical Observatories of Jai Singh" (1918), "A Guide to the Old Observatories" (1920), "Astronomical Instruments in the Delhi Museum" (1921) and "The Bakhshālī Manuscript" (1927). He also wrote on the two Aryabhattas and numerous other topics relating to Hindu science.

Mr. Kaye aroused a great deal of opposition on the part of Hindu mathematicians because of his conclusions that the early writers were dependent solely upon the Greeks and showed little originality except in the framing of fancifully worded problems. In fact, he clearly belonged to that school which asserts that pure mathematics never flourished in the Far East except as it adapted the theories of the West. Nevertheless, India is indebted to him for this very opposition, for it encouraged her scholars to study sources more thoroughly than before and to seek to base their claims upon more substantial foundations than mere tradition.

The best known of Mr. Kaye's contributions is his study of the Bakhshālī Manuscript, published as volume 43 of the Archeological Survey of India. This appeared only two years before his death and represents a painstaking examination of the internal evidence leading to a closer approximation to the date of the work than had been theretofore possible. It is too early to know the reaction of Sanskrit scholars to his conclusions, but in any case he has set them forth in such a logical fashion as to present a clear issue. No doubt the evidence in rebuttal, in the argument for an earlier date, will be assembled with equal care.

Mr. Kaye left a widow, a son, who has recently entered the India army, and two daughters.

DAVID EUGENE SMITH

NAOMASA YAMASAKI

NAOMASA YAMASAKI died at his home in Tokyo on July 26 of this year after a long illness at fifty-nine years of age. He was professor of geography and head of the Geographic Institute in the Tokyo Imperial University, a member of the Imperial Academy of Sciences, the Imperial Earthquake Commission and the Japanese National Research Council and foreign

member of the Gesellschaft für Erdkunde at Berlin. He was the representative of the Japanese National Research Council on the International Committee on the Oceanography of the Pacific and the chairman of the Japanese Committee on the Oceanography of the Pacific.

Professor Yamasaki was the foremost geographer in Japan. Although his interests in geography were broad, he himself specialized in physiographic subjects, especially the effects of earthquakes in modifying topographic features. His investigations were of a high order of excellence and his results were skilfully presented. Besides his scientific attainments, Professor Yamasaki was a connoisseur in many, if not all, of the different branches of Japanese fine arts and he was considered one of the foremost living masters of classical Japanese. Personally Professor Yamasaki was a most delightful man, a companion of inexhaustible resources for entertainment. He possessed extraordinary capacity for organization and for getting groups of men to work together harmoniously. As an indication of the regard and affection in which he was held the words of one of the distinguished younger men of Japan may be quoted, "We feel as if we had lost our father in the scientific world."

In the death of Professor Yamasaki not only have his family, his numerous friends and Japanese science suffered a great loss, but also international science, for he was one of the leaders in international scientific cooperation in the Pacific.

T. WAYLAND VAUGHAN

RECENT DEATHS

GEORGE ALFRED GOODENOUGH, professor of thermodynamics at the University of Illinois, died on September 30 at the age of sixty-one years.

DR. FRANK HURLBUT CHITTENDEN, for more than thirty-eight years connected with the entomological work of the Department of Agriculture, died on September 15 in his seventy-first year.

PROFESSOR L. H. COOKE, professor of mine surveying at the Imperial College of Science and author of many improvements and inventions relating to surveying instruments, died on August 23.

Nature reports the death of Mr. Arthur Berry, O.B.E., vice-provost of King's College, Cambridge, author of a "Short History of Astronomy" and of many mathematical papers, on August 15, aged sixty-six years, and of Anthony Collett, author of "The Heart of a Bird" and other natural history books and a member of the staff of the London *Times*, on August 22, aged fifty-two years.

SCIENTIFIC EVENTS

THE IMPERIAL MYCOLOGICAL CONFERENCE

THE second Imperial Mycological Conference for the prevention of diseases of tropical and sub-tropical crops within the British Empire was opened on September 23 at the Imperial College of Science, South Kensington. The first conference was held in 1924, when it was decided to hold one every five years.

According to the report in the London *Times*, Lord Buxton, chairman of the committee of management of the Imperial Bureau of Mycology, Kew Green (the organizers of the conference), presided, and was accompanied by the director of the bureau, Dr. E. J. Butler, F.R.S. The delegates represented the Dominion Governments of Canada, Commonwealth of Australia, Irish Free State, New Zealand, Southern Rhodesia and India, and the governments of Barbados, British Guiana, Ceylon, Fiji, Gambia, Gold Coast, Jamaica, Nyasaland, Sierra Leone, Straits Settlements, Federated Malay States, Tanganyika, Trinidad and Uganda. Others present were Dr. H. R. Briton-Jones, of the Imperial College of Tropical Agriculture, Trinidad, and Major R. O. Archibald and Mr. R. E. Massey, who attended in the capacity of experts loaned by the government of the Sudan.

Lord Buxton, opening the conference, stated that a new building for the use of the bureau was being erected at Kew, at a cost, with fittings, of £12,000. A grant of £8,000 had been made by the Empire Marketing Board, and the balance was drawn from the bureau's reserves, built up by Dr. Butler. An admirable site had been obtained near the Royal Herbarium, Kew, which gave the bureau the advantage of being able to rely on the cooperation of Dr. Hill, director of Kew Gardens, and his staff.

A paper giving a summary of plant protection regulations in the dominions and colonies was prepared by the Imperial Bureau of Mycology. It showed, according to the *Times*, that most of the dominions and colonies had taken measures to exclude specified plants, either completely or from certain places only. In a few cases all plants from certain places were excluded. Most governments provided for the compulsory examination of all plant imports, or their fumigation against insects. In a few cases, examination on arrival was restricted to certain specified plants. In practically all cases where there was inspection at the port of arrival, plant packings were also treated or destroyed. Internal plant protection measures ordinarily included the appointment of inspectors, with powers to enter and inspect the crops and usually to prescribe treatment on lines which were

ordinarily specified in advance. In some cases the inspectors themselves had powers to order the destruction of diseased plants, but in many this power must be granted in each case by higher authority. Similarly, powers of quarantining a holding or nursery frequently require reference to higher authority. In the majority of cases compensation was payable at the diseretion of the government, but in some it was restricted to cases where healthy plants had to be destroyed, or to destruction of certain plants, or to the complete eradication of a crop with cessation of growing that crop in the area.

There was prohibition of the sale of any diseased plant in Canada, Kenya and some other places; and a similar prohibition, in regard to certain specified diseases only, in the Irish Free State, New Zealand and South Africa. Inspectors could examine any plant exposed for public sale, and order treatment or destruction in Canada, but in Victoria destruction required higher authority.

In one or two cases there were powers, either to prevent land passing out of cultivation of a specified crop until prescribed treatment or destruction of that crop had been carried out, or else to destroy after due notice any plant of a specified crop found on unoccupied land. Most countries were now prepared to issue certificates of health of consignments intended for export to countries requiring such certificates. In a few, export of certain consignments was apparently not allowed without inspection and certification. Several countries had special regulations governing the transit of consignments of living plants across their territories. Seeds appeared to be seldom subject to import regulations. In Australia the commonwealth government in general made itself responsible for the regulation of imports and exports into and out of the country, while the individual states usually controlled the internal regulations, while keeping powers for imports and exports also.

THE BRACKENRIDGE CLEMENS MEMORIAL

THE Academy of Natural Sciences of Philadelphia announces that through the generosity of Dr. James B. Clemens there has been established at the academy a fund to be known as the Brackenridge Clemens Memorial Fund. Dr. Brackenridge Clemens, father of Dr. James B. Clemens, was America's pioneer student of the Microlepidoptera, and his collections and types formed the nucleus of the series of that suborder of insects now in the entomological department of the academy. The announcement says:

Born in Wheeling, West Virginia, January 31, 1825, Brackenridge Clemens received his early education at the Virginia Military Institute, and after his graduation there he matriculated at the University of Pennsylvania, medical department, graduating with the class of 1848. Much of his life was spent at Easton, Pennsylvania, and his first contribution to entomology was published in the year 1859, in the *Proceedings* of the Academy of Natural Sciences of Philadelphia. Between that year and his premature and untimely death in 1867, the elder Dr. Clemens published eighteen papers, eight in the pages of the *Proceedings* and *Journal* of the Academy, and ten in the *Proceedings* of the Entomological Society of Philadelphia, all but one bearing upon the Microlepidoptera. In these contributions he described some hundreds of new species and thirty-one new genera, thus creating the first authoritative literature on the Microlepidoptera to appear in America. In 1903, Dr. August Busck, an outstanding student of the tineid section of the Microlepidoptera, appraised Dr. Clemens's contributions as "a series of systematic and biological articles which yet remain the most important contribution to our knowledge of American Tineina." During the troubled period of civil war days few were able to carry on in the atmosphere of placid thought which scientific work requires. When it is realized that while Dr. Brackenridge Clemens bore his share of the struggle of the day as an officer in the Union Army, and that his foundation of an important field of scientific endeavor was laid on the threshold of and during that great struggle, his example and devotion to his work can not be other than an inspiration. H. T. Stainton, the eminent British microlepidopterist, regarded Clemens's work so highly that in 1872 he reprinted in London the papers on Tineina under the title "The Tineina of North America," together with his correspondence with Dr. Clemens, which latter gives a delightful picture of the breadth and lucidity of mind of the American worker.

The Brackenridge Clemens Memorial Fund will provide for the care, elaboration and housing of the collections of Microlepidoptera at the academy, along lines already made possible by Dr. James B. Clemens's assistance; will permit the increase of a recently established special memorial library on the suborder, and will assist in the publication of monographs and similar studies based on the collections covered by the memorial.

The original collection of Dr. Brackenridge Clemens has been splendidly preserved and is regularly consulted by students of the Microlepidoptera. The entire series of the suborder is now housed in standard glass-top boxes contained in steel cabinets, while the Memorial Library contains copies of all of Dr. Brackenridge Clemens's publications and the more important works of other authors on the subject covered by the memorial. The collections of Microlepidoptera now in the custody of the academy also include the types and paratypic series of a number of authors other than Clemens, and excellent representative collections received from Mr. Frank Haimbach, of the academy's entomological staff; Dr. Annette Braun, of Cincinnati, Ohio, and other students of these beautiful and diminutive moths.

A portrait of Dr. Brackenridge Clemens now hangs in the hall of the academy, which organization and its kindred entomological society were so closely and intimately associated with his scientific activities. His bril-

liant and invaluable studies hold an enviable place in entomological science in America, and the memorial will concretely bring the inspiration of his work to those who follow his path.

THE PARC NATIONAL ALBERT IN THE BELGIAN CONGO

DR. HENRY FAIRFIELD OSBORN, president of the American Museum of Natural History, and Dr. John C. Merriam, president of the Carnegie Institution of Washington, have been appointed American members on the commission of the Parc National Albert, Belgian Congo. A correspondent writes:

The Parc National Albert, the first national park to be established in Africa, is a royal institution. The idea of establishing national parks in Belgian territory was first conceived by King Albert during his journey through the national parks of the United States in 1919. He recognized at once that similar Belgian parks should be located, not in the densely populated areas of the mother country, but in the vast wilderness of the Belgian Congo. This idea for the first time took definite shape after the proposition made by the late Carl Akeley, naturalist and explorer, who, following his expedition to the volcanic region of Northern Kivu in 1921, recommended that a sanctuary for gorillas be established there for the preservation of that rapidly disappearing species. This proposal was sanctioned by royal decree and the Parc National Albert was established in the eastern part of the Belgian Congo.

In November, 1926, Mr. Akeley and his wife, Mary L. Jobe Akeley, accompanied by Dr. J. M. Derscheid, the Belgian zoologist, returned to the Kivu District on the Akeley-Derscheid Mission. The purpose of this mission was to make a general scientific survey of the Parc National Albert and to make recommendations for a scientific research station therein.

It was on this expedition that Mr. Akeley died and was buried in the heart of the Gorilla Sanctuary. Following his death, Mrs. Akeley and Dr. Derscheid remained in the region continuing their investigations and in 1928 they made a formal report on the findings of the Akeley-Derscheid Mission which was presented with a plan of administration to His Majesty.

By Royal Decree, in June, 1929, King Albert established a plan of administration and enlarged the original area of the park to about 500,000 acres in the interest of scientific research. The decree prohibits under severe penalties the killing, capture or molestation of any wild animal within the area, including those which are considered dangerous. It is also prohibited to destroy or remove any tree or wild plant or to change in any way the aspect of the landscape. The sanctuary will be policed by Belgian colonial officers and no one will be allowed to enter without a special permit.

Many rare species of animals which have almost disappeared from other parts of the world are making their last stand in this section of Africa, and it is King Albert's purpose to preserve them so that scientists may study them in their natural and primitive surroundings. Scientists recognize that the study of animals in their natural habitat is more useful than the study of captives or dead specimens in laboratories.

The appointment of Professor Osborn and Dr. Merriam to serve on the Parc National Albert Committee is particularly gratifying to those connected with the Parc because of their great interest in this project from its very beginning and because of their active support of genuine conservation movements throughout the world.

THE FIFTIETH ANNIVERSARY OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ON April 5, 7, 8 and 9, 1930, many of the world's engineers will meet in New York, Hoboken and Washington to celebrate the fiftieth anniversary of the founding of the American Society of Mechanical Engineers. The exercises will be non-technical in nature and will stress the humanistic side of engineering. They will be preeminently an exchange of greetings between nations through the medium of a series of papers presented by a prominent engineer from each of sixteen countries or geographical divisions of the world. These papers will develop the theme of what engineering has done for each author's country in a national sense and also for the advancement of world culture and civilization. These engineers will also endeavor to forecast the lines along which engineering may be expected to develop in the future, and to inform the convocation of some of the great engineering problems confronting their respective nations.

The program will be carried out in three parts. At New York, on April 5, the delegates will be conducted to the McGraw-Hill Company and will be entertained in the offices of the *American Machinist*. This portion of the program will commemorate the preliminary meeting of organization of the American Society of Mechanical Engineers held on February 16, 1880.

The second portion of the program will be held at Stevens Institute, Hoboken, N. J., where the organization meeting of the society was held on April 7, 1880. With the idea of depicting the history of the society and of engineering during the past fifty years and the society's future, a pageant will be enacted. This pageant will feature the life history of an individual called "Control," and will utilize the most modern inventions of engineering in tracing this allegorical conception.

The third part of the program, the main sessions, in which each of sixteen of the world's distinguished engineers will present a summary of his paper, will be held in Washington on April 7 and 8. Washington has been selected to accord with the national and international character of the celebration and the national and international scope of the society's future services to mankind.

Another function will be the Founders' Luncheon, also to take place in Washington on April 8. Follow-

ing the luncheon, a session will be held in the U. S. Chamber of Commerce Building at which various awards will be formally bestowed. Honorary memberships will be awarded to individuals who have rendered conspicuous service to the society, and the Holley, Melville, Gantt, American Society of Mechanical Engineers, Fiftieth Anniversary and other newly founded medals of distinction will be conferred.

At the dinner, also on Tuesday, April 8, the president of the American Society of Mechanical Engineers will present a paper which will be the national report for the United States and will outline the future possibilities of service of the society. At this time also an eminent scientist will review the past contributions of science to engineering, the relation of engineering with respect to science and the influence of science on the future of engineering. In addition, a prominent American will present, from an international viewpoint, an evaluation of the influence of engineering invention, development and accomplishments upon the cultural, social, economic and political progress of mankind, and an outline of the future of engineering in solving the problems of mankind and in promoting international amity.

Other gatherings of interest include a reception at the White House for delegates and members of the society and their guests, and the American Society of Mechanical Engineers president's and officers' reception on the evening of the same day. There will also be trips about New York and Washington, during which the delegates, American Society of Mechanical Engineers' members and their guests will view the outstanding points of interest of those cities.

THE CELEBRATION OF "LIGHT'S GOLDEN JUBILEE" BY NEW YORK STATE

THE people of New York State are called upon to observe October 21 as Light's Golden Jubilee day and display their appreciation of the work of Thomas A. Edison, in a proclamation by Governor Roosevelt made public at the executive offices. The proclamation reads:

PROCLAMATION

WHEREAS, On October 21, a half century will have elapsed since Thomas A. Edison, equally distinguished as scientist, inventor and benefactor of mankind, gave the world the comfort and convenience of the incandescent light, and

WHEREAS, It is incumbent upon all the living beneficiaries of the outstanding invention to signalize the fiftieth anniversary of the culmination of the research and efforts of Edison, foremost in the broad, uncharted field of electrical experimentation, and

WHEREAS, New York State in the development of the incandescent light and other splendid inventions of this world-renowned developer of those mysterious advantages hidden away in the partly explored realm of electricity, has profited commensurately with the rest of the world by the accomplishments of the great Edison, who literally has lighted the path of humanity, and

WHEREAS, The consciousness and appreciation of those benefits and advantages afforded by the work and efforts of Edison have provoked and inspired an observance of this date as a world-wide expression of gratitude to Thomas Alva Edison, an observance in which the Empire State will participate with a vigor tantamount to its admiration of this truly great man himself,

Now, therefore, I, Franklin D. Roosevelt, Governor of the State of New York, do proclaim October 21 Light's Golden Jubilee Day and do urge upon all our people, youth and adult alike, the propriety and fitness of a statewide manifestation of their high regard for Thomas Edison and an appreciation of his genius by the conduct of commemorative exercises in our schools, in our civic organizations and fraternal societies, supplementing these with the illumination on the night of October 21 of the great modern structures, the utility of which has been experienced by the invention of the incandescent lamp.

SCIENTIFIC NOTES AND NEWS

PROFESSOR ALBERT A. MICHELSON, who has suffered an attack of pneumonia after an operation in Chicago, is reported to be somewhat better at the time of going to press with the present issue of SCIENCE.

PROFESSOR IVAN PAVLOV, after attending the Physiological and Psychological Congresses, returned to Leningrad in time to celebrate his eightieth birthday. In recognition of the event the Soviet government gave $50,000 to his laboratory and decided to close to traffic a street the noise from which might interfere with his experiments.

DR. ARTUR HAAS, professor of physics at the University of Vienna, and Professor F. G. Donnan, of the University of London, have been invited by the Gibbs Committee, a committee representing the departments of physics and chemistry of Yale University, to be editors of a commentary on the works of J. Willard Gibbs. A number of distinguished physicists and chemists will be among the collaborators. In consequence of undertaking this work, Dr. Haas will be obliged to postpone his visit to the United States.

DR. RALPH MODJESKI, of Chicago, has been awarded the John Fritz gold medal "For notable achievement as an engineer of great bridges combining the principles of strength and beauty." The award, which was unanimous, was made by the John Fritz Medal

Board of Award, composed of sixteen recent past presidents of the four national societies of civil, mining and metallurgical, mechanical and electrical engineers.

As the result of the balloting for officers to head the American Society of Mechanical Engineers for 1930, the tellers of the election announce the following as having been chosen: *President,* Charles Piez, chairman of the board, Link-Belt Co., Chicago, Illinois; *Vice-presidents,* Paul Doty, chairman of the board, Minnesota State Board of Registration, St. Paul, Minn.; Ralph E. Flanders, manager, Jones & Lamson Machine Co., Springfield, Vt.; Ernest L. Jahncke, assistant secretary of the Navy; Conrad N. Lauer, president, Philadelphia Gas Works.

DR. JOHN C. HEMMETER, Baltimore, has been elected an honorary member of the Academy of Medicine of Paris.

Nature reports that the retirement of Professor F. W. Oliver from the Quain chair of botany at University College, London, was made the occasion of an appeal for funds to commemorate the sixty-nine years' association of Professor Oliver and of his father, Professor Daniel Oliver, with the chair of botany at University College. The appeal resulted in the collection of a sufficient sum of money to enable the committee to found an Oliver Commemoration Bursary of the annual value of about £20 for the purpose of assisting graduate students of University College to prosecute research in botany. At a dinner given to Professor Oliver at University College, under the chairmanship of Professor F. O. Bower, the committee's decision with regard to the disposal of the funds was announced and a cheque for his personal use, together with an album of the autograph signatures of the contributors to the fund, were presented to Professor Oliver.

DR. RAY S. BASSLER has been appointed head curator of the department of geology of the U. S. National Museum to succeed the late Dr. George P. Merrill. Dr. Bassler has been connected with the division of paleontology of the museum since 1901.

DR. P. H. ROLFS, formerly director of the Florida experiment station and dean of the Florida State College of Agriculture, has been invited by the Brazilian ambassador to establish and conduct in Brazil a college of agriculture.

FRED C. BERQUIST, associate professor in the Carnegie Institute of Technology, Pittsburgh, has been appointed expert in mineral economics in the bureau of the census.

DR. ESMOND R. LONG, professor of pathology, University of Chicago, has been appointed editor-in-chief of the *Journal of Outdoor Life,* which is published by the National Tuberculosis Association.

SIR FREDERIC STUPART, having retired from the directorship of the Canadian Meteorological Service, has withdrawn also from being associate editor of the *Journal of the Royal Society of Canada,* and his successor, Mr. John Patterson, also succeeds him as associate editor.

THE prize of $250, given by the Scientific Apparatus Makers of America to the contributor presenting the best article on instrument-making other than optical that has been published in the *Journal of the Optical Society and Review of Scientific Instruments,* has been awarded for the year 1928 to Mr. N. E. Bonn, of the Leeds and Northrup Company, for his article on "An Improved Rosa Curve Tracer," appearing in the issue of September of that year. Dr. F. K. Richtmyer, professor of physics at Cornell University, is chairman of the committee on awards.

DEAN DONALD B. PRENTICE, head of the department of mechanical engineering at Lafayette College, will represent the college at the World Engineering Congress to convene in Tokio the latter part of October. Dean Prentice has included in his trip to Japan a trip around the world on which he started in June and during which he visited the chief engineering colleges in other countries. He will return in February, 1930, after a month's visit in Honolulu.

ASSOCIATE PROFESSOR P. H. SCHWEITZER has returned to the engineering experiment station of the Pennsylvania State College after a year at the University of Dresden, from which he received the degree of Ingenieur Doctor.

DR. F. SILVESTRI, of the school of agriculture, Portici, Italy, has been appointed associate professor of entomology at the University of Minnesota for the spring quarter, 1929, and during that time will give a series of lectures on advanced economic entomology.

DR. H. WALTER, of the University of Heidelberg, has arrived in New York. He will spend six months at the Desert Laboratory in Tucson, Arizona, and the latter half of the year at the University of Nebraska. Dr. Walter is hoping to meet some of his colleagues in American universities before beginning his work in Arizona. He is particularly interested in the study of plant saps in relation to environment.

DR. V. KRAJINA, assistant of the botanical institute of the Charles University, Prague, has gone to the Hawaiian Islands to study their fauna and vegetation under the auspices of Yale University and of the Czechoslovak Ministry of Education.

DR. R. N. CHAPMAN, chief of the division of entomology and economic zoology at the University of Minnesota, sailed for Honolulu, Hawaii, on September 7. Dr. Chapman was requested to visit Hawaii by the Pineapple Growers Experiment Station and to consult with them regarding the possible insect carriers of pineapple diseases. He will return to the University of Minnesota about December 1.

CHAS. R. FETTKE, professor of geology at the Carnegie Institute of Technology, Pittsburgh; W. A. Copeland, assistant professor, and W. H. Seifert completed the field work on the geological survey of the Bradford oil field of northwestern Pennsylvania and adjacent portions of New York State during the past summer for the Pennsylvania Topographic and Geologic Survey and have returned to Pittsburgh.

DR. REMINGTON KELLOGG, of the division of mammals of the U. S. National Museum, and Mr. Norman Boss, of the division of paleontology, left Washington on October 3 for western Alabama to collect fossils for a period of one month. This expedition is being carried on in cooperation with The Carnegie Institution of Washington. The specimens will become the property of the U. S. National Museum, but will be reported on by Dr. Merriam and Dr. Kellogg.

THE committee on scientific research of the American Medical Association invites applications for grants of money to aid in research on problems bearing more or less directly on clinical medicine. Preference is given to requests for moderate amounts to meet specific needs. Application forms can be obtained from the committee at 535 North Dearborn Street, Chicago, Illinois.

A GENERAL discussion arranged by the Faraday Society on "Molecular Spectra and Molecular Structure" was held in the department of physics of the University of Bristol on September 24 and 25, under the chairmanship of Professor T. M. Lowry. The proceedings were in three parts, dealing, respectively, with band spectra in the visible and ultra-violet, the Raman effect and infra-red spectra. Among the well-known foreign men of science who took part were Dr. H. A. Deslandres, Professors R. T. Birge, R. S. Mulliken, F. Hund, V. Henri, E. Hulthén, Sir C. V. Raman, R. W. Wood, J. C. McLennan and J. Cabannes.

DR. IRVING LANGMUIR, president of the American Chemical Society, has returned from a lecture tour in the Mid-West where he gave five lectures before joint meetings of the local sections of the American Chemical Society. In another lecture tour he will address joint meetings of the sections of the Chemical Society in Philadelphia, Thursday, October 17; Washington, Friday, October 18; New York, Saturday (luncheon), October 19; Rochester, Monday, October 21; Buffalo, Tuesday, October 22; Detroit, Wednesday, October 23; Cleveland, Thursday, October 24; Ada, Ohio, Friday and Saturday, October 25 and 26, at the regional meeting of Northern Ohio. The title of his lecture on this tour will be "Chemical Reactions Produced by Heating Tungsten or Platinum Filaments in Gases." The tours have been arranged by the Local Sections Officers Committee.

DR. M. S. MARSHALL, secretary of the Pasteur Society of Central California, writes that a meeting was held at the Hotel Whitcomb, San Francisco, on September 25. The program consisted of a symposium on epidemic cerebro-spinal meningitis. Dr. J. C. Geiger, associate professor of epidemiology at the University of California and senior surgeon of the U. S. Public Health Service, discussed the epidemiology in the United States. Dr. H. H. Darling, research associate in medicine, Hooper Foundation, discussed his observations of meningitis along the Pacific steamship routes, showing an important focus of an epidemic in Shanghai, accounting for the susceptibility of the Filipinos and suggesting the presence of new strains not covered by the usual anti-meningococcus serums. Dr. J. C. Perry, senior surgeon, U. S. Public Health Service, medical director of the fifth district, presented the incidence of the disease on incoming ships during the past year, and governmental precautions. Dr. E. B. Shaw, Children's Hospital, San Francisco, discussed the treatment of meningitis, particularly as regards modes of serum therapy and their efficacy. Dr. W. H. Kellogg, director of the bacteriological laboratory of the State Board of Health, discussed the bacteriology, emphasizing the various strains, and suggesting that there may well be only a few type strains, others being varieties of these, indeterminable by carbohydrate fermentation reactions. An interesting discussion of half an hour followed the speakers. Thirty-one nominees were elected to membership. The total membership now is 263.

THE twelfth American Country Life Conference will be held at Iowa State College from October 17 to 20. The president of the American Country Life Association is Frank O. Lowden, a former governor of Illinois. Arthur M. Hyde, Secretary of Agriculture, will be among the speakers.

A GIFT of $100,000 has been made by Mr. Edward S. Harkness to the Research Laboratory of Physiological Optics of the Wilmer Ophthalmological Institute of the Johns Hopkins Medical School for the study of eye diseases in relation to test results. The study will be conducted under the direction of Dr.

C. E. Ferree, director of the laboratory, and Dr. Gertrude Rand, associate professor of research ophthalmology.

THE University of Minnesota has purchased the apicultural library of the Reverend Francis Jager, St. Bonifacius, Minnesota. This is one of the most complete collections of books and periodicals pertaining to bee-keeping that has been gathered together in this country. It is particularly rich in the number of old and rare German works.

THE trustees of the Carnegie United Kingdom Trust have announced that they will grant the Museums Association, Great Britain, the sum of £1,500, spread over a three-year period. This grant is made to enable the association to establish a central office and employ a permanent staff which will work under the honorary officers.

ARRANGEMENTS are being made by the Queensland Government for continuance of the research work which the British Scientific Expedition has been carrying out for the past twelve months on the Great Barrier Reef. Mrs. Yonge, leader of the expedition, who is returning to England with data about coral and other formations on the Reef, said that the stay at Low Island should be of great value to Queensland economically. It would open the way to new avenues of industry. For example, there were possibilities of a sardine fishery in Torres Straits and the Capricorn Islands. The Queensland government has applied to the federal government to be allowed to retain the structures at Low Island so that the work can be carried on without any waste of time.

UNIVERSITY AND EDUCATIONAL NOTES

DR. ALEXANDER G. RUTHVEN, professor of zoology, has been unanimously elected president of the University of Michigan by the Board of Regents. He succeeds Dr. Clarence C. Little.

DR. CLARENCE YOUNG, of the University of Iowa, goes to Colgate University this year to take charge of a new orientation course in biological science. This course will cover biology, zoology and psychology taken up from the evolutionary standpoint.

DR. WILLARD BERN has been appointed instructor in geology at the Ohio State University.

NEW appointments to the staff of the department of chemistry, Washington Square College, New York University, include those of Dr. B. Pichler, of the University of Graz, and Dr. J. Spence, of the University of Edinburgh. Assistant Professors Muller, Niederl and Ritter have been promoted to associate professorships, and Drs. Ehret, Mouquin and Partridge to assistant professorships.

THE following changes may be noted in the staff of the department of botany of Michigan State College: Dr. J. H. Muncie, of the U. S. Department of Agriculture, stationed at Ames, Iowa, has been appointed in place of Dr. G. H. Coons, who left last May to take charge of the sugar beet disease work of the U. S. Department of Agriculture at Washington; Mr. H. C. Beeskow, last year instructor at the University of Cincinnati, in the place of Orman E. Street, now of the Connecticut Agricultural Experiment Station; Mr. E. S. McDonough, of Marquette University, instructor in botany in the place of F. C. Strong, who resigned to do graduate work at the University of Michigan.

WITH a registration of 54 first-year students and 47 second-year students and a teaching and laboratory staff of 24, the school of medicine of the University of Southern California has begun its second year. Last fall when the school was reopened after ten years' suspension only the first year of medicine was taught. This fall the second year of pre-clinical work has been added. Next fall it is proposed to add the third year, and in 1931 the fourth year of work. Under the direction of Dean William D. Cutter, formerly dean of Post-Graduate Medical School, New York City, there has been brought together a staff of five professors, two associate professors, four instructors, six demonstrators and six assistants. The appointments include Dr. Paul S. McKibben, formerly head of the department of anatomy of Western Ontario Medical School, as professor of anatomy; Dr. Harry J. Duel, formerly professor of physiology at the University of Maryland, as professor of biochemistry; Dr. Ernest M. Hall, recently assistant professor of physiology at Stanford University, as professor of pathology, and Dr. Burrell Otto Raulsten, practising physician of Los Angeles, as professor of medicine. Other appointments include Dr. John F. Kessel, associate professor of parasitology at the University of California at Los Angeles, as associate professor of bacteriology and parasitology; Dr. Clinton H. Thienes, assistant professor of pharmacology at the University of Oregon Medical School, as associate professor of pharmacology; Dr. Esther H. Bartosh, formerly of the City Maternity Service, Los Angeles, instructor in anatomy; Dr. Philip Randall Fulton, instructor in anatomy; Frederick C. Messer, formerly instructor in physiological chemistry at Syracuse University, instructor in biochemistry, and Dr. Lawrence Parsons, formerly assistant pathologist, Los Angeles County Hospital, instructor in pathology.

DISCUSSION

THE DISCOVERY OF INSECT TRANSMISSION OF PATHOGENIC MICRO-ORGANISMS

THE recent quotation which appeared in this journal[1] on "The Seventieth Birthday Anniversary of Theobald Smith" brings to mind another pioneer on studies of insect transmission of pathogenic micro-organisms, one who is frequently ignored by writers of medical text-books and of books and articles for popular consumption. Reference is being made to Merton B. Waite, the able plant pathologist who discovered, and first published in 1891,[2] that bees often carry the bacillus that is responsible for that disastrous scourge on pear, apple and other fruit-trees popularly known as fire-blight.

It is not at all surprising that investigators and "popularizers" of human and animal diseases should have overlooked the work of a plant pathologist, and it can not truthfully be said that the latter group are freer from sin in ignoring the work of other pathologists than their medical brethren. It is just another illustration of the great difficulty involved in coordinating knowledge, even though the branches run so closely parallel to each other as human, animal and plant pathology. The chief difference between Waite's work and Smith's is that while the former was studying a "passive" insect carrier the latter was working with an "active" one. Coming at a time when learned doctors were still arguing as to whether or not there could be such a thing as a bacterial disease in the plant kingdom, Waite's discoveries were truly remarkable. He not only helped settle that dispute[3] but made such further advances in the knowledge of bacterial diseases of plants, particularly the one mentioned above, that it has kept plant pathologists busy checking Waite's work up to this very day. While some of his views expressed more than thirty-five years ago may have to be discarded, there can be no question that as far as insect transmission of pathogenic micro-organisms is concerned his proof was ample. The great Erwin F. Smith has the following to say of this work:[4]

Waite isolated the pear-blight organism, grew it in pure cultures and proved its infectious nature by inoculations. With such proved cultures he sprayed clusters of pear flowers in places where the disease did not occur and obtained blossom-blight, and later saw this give rise to the blight of the supporting branch, found the organism multiplying in the nectar and re-isolated it from the blighting blossoms. On some trees he restricted the disease to the sprayed flowers by covering them with mosquito netting to keep away bees and other nectar-sipping insects. On other trees where the flowers were not covered he saw bees visit them, sip from the inoculated blossoms and afterwards visit blossoms on unsprayed parts of the tree, which then blighted. Finally he captured bees that had visited such infected blossoms, excised their mouth parts, and from these, on agar-poured plates, obtained *Bacillus amylovorus,* with colonies of which he again produced the disease. These experiments were done in several widely separated localities with identical results. I saw them and they made a great impression on me.

In conclusion it may be of interest to point out that Theobald Smith and Merton Waite were both members of the same institution when their epoch-making discoveries on insect transmission of disease-producing agents were made, one working in the animal division and the other in the plant division. Although Waite's first announcement of this phenomenon preceded Smith's[5] by two years the two men had evidently worked on insect transmission more or less at the same time and independent of each other. Waite, it should be noted, is still connected with and actively engaged in that remarkable public institution, the U. S. Department of Agriculture.

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THE RATE OF ABSORPTION OF EPINEPHRINE FROM THE SUBCUTANEOUS TISSUE

IT is experimentally established that the subcutaneous injection of 1 mg of epinephrine per kilo does not lead to a rise in blood pressure of rabbits, cats and dogs. This is generally ascribed to the fact that epinephrine is absorbed very slowly from the subcutaneous tissue. A five times smaller dose which we used in work on carbohydrate metabolism Cannon[1] designates as "huge" and as "far beyond physiological limits," because he believes that subcutaneously injected epinephrine leads to disturbances in circula-

[1] SCIENCE, 70: 193–194, 1929.

[2] *Bot. Gaz.*, 16: 259, 1891; *Proc.* Amer. Assoc. Adv. Sci., 1891: 315, 1892; *Trans.* Peninsula Hort. Soc. Fifth Ann. Session, pp. 32–34, 1892.

[3] The very heavy verbal artillery fired at the time by Erwin F. Smith at Alfred Fischer has tended to drown out the extremely modest verbal offerings of Waite and others. Up to the present moment he has not published a full account of his early experiments although enough, fortunately, has appeared in various horticultural and agricultural journals to enable one to get a fair view of his work.

[4] "Bacterial Diseases of Plants," Philadelphia, 688 pp., 1920.

[5] Bur. Anim. Ind., U. S. Dept. Agr. Bul. 1, 1893.

[1] W. B. Cannon, *Physiol. Reviews*, 9: 399, 1929.

tion. This belief can only be based on the tacit assumption that subcutaneously injected epinephrine is absorbed very rapidly into the blood stream, which is contrary to accepted experimental evidence. Since the discovery of the glycosuric action of epinephrine twenty-seven years ago, our dose of 0.2 mg per kilo and larger doses have been used in virtually hundreds of animal experiments by a great number of authors. In view of this the criticism of Cannon, if it were well founded, would be of far-reaching importance and it may therefore be worth while to examine the evidence he sets forth. First he calculates the equivalent of our dose of 0.2 mg per kilo of rat for a man of 70 kilos and arrives at the figure of 14 mg. This *argumentum ad hominem* can not impress those who know that the sensitivity of various species to drugs and hormones shows the greatest variation. There can be no doubt that the rat, rabbit, cat and dog are less sensitive to subcutaneously injected epinephrine than man. Secondly, Cannon states that pronounced physiological effects were obtained in rats with one twentieth of our dose. He does not mention the mode of application of epinephrine or describe the nature of the physiological effects observed. It is true that the *intravenous* injection of 0.001 mg of epinephrine per kilo per minute raises the blood pressure of rats, but this argues in our favor because experiments made in this laboratory have shown that the *subcutaneous* injection of our dose which is two hundred times larger has no effect on blood pressure. Hence, the absorption from the subcutaneous tissue must proceed at a rate less than 0.001 mg per kilo per minute which is, according to Cannon, within the physiological range. The dose we injected was *non-glycosuric* in animals rich in glycogen.[2] Absence of glycosuria under these conditions is generally accepted as evidence that the dose is moderate. Glycosuria appeared only when epinephrine was injected in conjunction with glucose feeding.[3] Cannon argues that the highest blood sugar in these experiments came early and was associated with the lowest glycosuria, and he concludes from this that the "huge doses disturbed the circulation." The figures on which Cannon bases this argument are as follows. Average sugar excretion from 0 to one hour 12 mg, from one to two hours 13 mg, from two to three hours 15 mg and from three to four hours 15 mg. It needs hardly to be emphasized that the increase in the average sugar excretion from 12 mg in the first hour to 15 mg in the last hour is not significant and Cannon's criticism is therefore ill-based. The rather constant sugar excretion from hour to hour was used for the following argument. It is definitely known that epinephrine acts only as long as it enters the blood stream. Since the glycosuria persisted for four hours, the absorption of epinephrine from its subcutaneous depot must have persisted for at least that length of time and from this it was calculated that the rate of absorption was well within physiological limits. This could recently be confirmed experimentally by determining the amount of epinephrine remaining unabsorbed in the subcutaneous tissue of the rat at various time intervals after the injection. In experiments to be reported in extenso elsewhere the following average values were obtained. Recovered after one hour 65 per cent., after two hours 52 per cent., epinephrine still present after four hours. This is direct evidence that the absorption proceeds at a very slow rate and shows that Cannon's assumption that our results were due to overdosage is unfounded. It would also seem that the mere fact that smaller doses of epinephrine than those used by us still influence metabolism can hardly invalidate our results.

[2] C. F. Cori and G. T. Cori, *J. Biol. Chem.*, 79: 321, 1928.

[3] C. F. Cori and G. T. Cori, *J. Biol. Chem.*, 79: 343, 1928.

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THE CHEMICAL NATURE OF ENZYMES

IN his "Outlines of Biochemistry" Dr. Ross Aiken Gortner reviews Willstätter's conception of the structure of enzymes as follows:

> Both Willstätter and Oppenheimer take the view-point that enzymes are amphoteric electrolytes which exist in a particular colloidal state. Willstätter discusses this question at considerable length, the conclusion being that enzymes contain a special reactive group which either combines with, or possesses some particular affinity for, definite groupings in the substrate, thus accounting for the specificity of enzyme behavior. This special reactive group is attached to a colloidal carrier, and enzyme action is determined in part by the affinity of the active group for the substrate and in part by the colloidality of the entire aggregate. He notes that when the colloidal properties of the aggregate are destroyed, then the activity of the enzyme likewise disappears.

Recently, in connection with a study of the insoluble tyrosinase of the velvet bean seed coat the writer prepared an aqueous solution from a mushroom (species not yet determined) which, when filtered through ordinary filter-paper appeared to be very clear and was found to possess marked activity toward the chromogen, 3.4-dihydroxyphenyl alanine, a constituent of velvet bean cotyledons. This filtrate was dialyzed over night in a cellophane dialyzing tube and the dialysate was found to be quite active,

although it was more dilute than the original filtrate. A repetition of the experiment duplicated the results.

Before using the dialyzing tubes they were tested with distilled water and apparently did not leak.

From these experiments it would appear that this particular mushroom contains a very active soluble tyrosinase which is either not colloidal or is so decidedly on the borderland between the crystalloidal and colloidal states as to invalidate a general application of the Willstätter conception.

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THE SECRETION OF ADRENALIN

THERE has been a great deal written on the subject of adrenalin reviving people after death. Dr. W. H. Schultz, of the University of Maryland, read a paper at the recent Physiological Congress in Boston showing that the factors ordinarily controlling the normal growth of adrenalin-secreting cells may be defective, in some instances, in a way that will make the gland capable of storing up adrenalin. Even thirty to fifty times the normal amount may be stored and if it is suddenly released can poison and even kill. Should one thousandth of the amount be suddenly released it would cause high blood pressure, whereas one hundredth of the amount would cause death.

It was chemical and biological studies that laid the foundation for the hospital treatment of hyperthyroidism—a dangerous disease involving questions of metabolism. Similarly this work lays a scientific foundation for hospital treatment of certain types of blood pressure.

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SIMON'S "LES ARACHNIDES DE FRANCE"

ALL students of the Arachnida will welcome another instalment (Part 3) of the long-awaited sixth volume of Eugene Simon's "Arachnides de France." This is a posthumous work carefully edited by his devoted colleagues, L. Berland and L. Fage. Simon began the publication of this great work in 1874, and the fifth volume was completed in 1884, volume 7, devoted to the Pseudo-scorpions and Opiliones, having been published in 1879. It was originally intended that volume 6 should treat of the families not considered in the previous volumes, but with the passing of the years while the author was busied with the preparation of his great work on the genera of the spiders of the world, this plan was abandoned. Instead, volume 6 was projected as in reality a new edition of the series; the earlier work was to be revised and brought down to date while the families which had been omitted were to be treated. Part I of the volume was published in 1914; the war intervened and at the time of Simon's death in 1924 no more had appeared. Fortunately, the manuscript was complete and the task of seeing the work through the press had been delegated to the present editors. By carefully executing this mission they have won the gratitude of all students of spiders throughout the world.

The present instalment, pages 533–772, completes the treatment of the family Argiopidae. The publisher is L. Mulo, Paris.

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HERMAPHRODITISM IN DENDRASTER

HEILBRUNN[1] has very recently reported in this journal two hermaphroditic specimens of Arbacia from Woods Hole. This increases the list of hermaphrodite echinoderms to five, two of Paracentrotus having previously been described by Herlant[2] and by Drzwina and Bohn,[3] respectively, and one of Sphaerechinus by Viguier.[4] While engaged in physiological investigations on the eggs of *Dendraster excentrica,* we found a hermaphroditic sand-dollar, the gonads of which were symmetrically divided into testicular tissue on the right of a diameter passing through the anus, and ovarial tissue to the left of it. The eggs were in better condition than the spermatozoa, and self-fertilization did not seem to be possible. As the first instance of hermaphroditism in the clypeastroid echinoderms, this circumstance may be worth record.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

DECEREBRATION OF THE DOMESTIC FOWL

THE domestic fowl has been little used in laboratory decerebration experiments because of the exceptionally high mortality that has accompanied such operations. Since there are obvious advantages in the use of the larger-sized bird, the following summary of procedure is presented in the belief that the method would be of interest. Domestic fowls

[1] SCIENCE, 69: 427, 1929.
[2] *Archives de Zool. Exp. et Gen.*, 57: 28, 1918.
[3] *Comptes Rend. Acad. Sci.*, 178: 663, 1924.
[4] *Comptes Rend. Acad. Sci.*, 131: 63, 1900.

that have been decerebrated by the method outlined have survived indefinitely, presenting typical pictures of decerebrate birds.

A preliminary fasting period of from eighteen to twenty-four hours was imposed upon the bird previous to operation.

The hen was secured in a cloth sack, the head and neck protruding, and anesthetized with ether. Feathers were plucked from the operative area from ear to ear and from the comb posteriorly to the first cervical vertebra. A transverse incision was made through the skin from ear to ear and the periosteum removed from the bones covering the cerebral hemispheres. Two holes were trephined over the center of each hemisphere, and with small bone forceps, the openings were enlarged, care being taken not to injure the dura mater, also carefully avoiding the longitudinal sinus. The dura mater was slit anteroposteriorly, after applying a solution of codrenin (cocaine 2 per cent. solution, with adrenalin 1:15000) to control hemorrhage. Using a small spatula the cerebral hemispheres were lifted, care being taken not to injure the brain stem. After the hemispheres were removed, hemorrhage was checked by using pledgets of cotton moistened with codrenin. Because of the larger blood supply, the control of hemorrhage is more of a problem in fowls than in pigeons. The usual procedure in decerebrating pigeons is to suture the dura mater and skin. This procedure was followed upon the first four birds operated, all these birds dying immediately following the operation. Autopsies of these birds revealed that death resulted from the pressure of blood clot upon the vital centers. Therefore, in all succeeding operations no attempt was made to suture the dura mater and skin. Extended over a period of two years fifty-four birds have been operated, the cerebral hemispheres being removed partially or completely. No ill results occurred from blood clot or from infection of operated areas, all birds surviving for indefinite periods.

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MARKING GEOLOGICAL SPECIMENS

DURING the past year we have very successfully used quick-drying lacquer for marking specimens both for use in elementary laboratory and for numbering working and museum collections. The process is simple, consisting only of placing a drop of lacquer on the specimen and writing upon it the significant letters or figures with steel pen and drawing ink.

The advantages in using lacquer over many other methods of specimen marking are several. It is permanent; it provides a smooth writing surface, and it can be secured in colors which may be used to indicate different sets, classes, groups or other divisions. The method is quick, drying after spotting, and marking being accomplished within half an hour. The colors may be contrasting with the specimens marked or closely matched to them. We have found a contrasting color ordinarily the most satisfactory, in most cases using white or orange with lettering in black ink.

The use of lacquer makes possible the marking of specimens which would otherwise be difficult. A deep drop may be used to cover granular or rough surfaces, and even when applied in considerable depth there does not appear the wrinkling or furrowing such as is common with the usual enamels. A single application has served to form a satisfactory writing surface on coarsely granular pyrite. The size of the lacquer spot commonly used is about three sixteenths of an inch in diameter, and is applied with a small brush. A spot of this size holds conveniently a letter and two figures, or two pairs of figures, one above the other.

EARL T. APFEL

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SPECIAL ARTICLES

ON THE NATURE OF GENE ACTION

THAT the structural units which give form to life, as we know it, are the inherited units called genes is becoming increasingly clear. But what these genes are and when and how they act are yet problematical. Experiments of the last two years have, however, furnished certain facts suggesting the answers to these questions. These facts resulted from treating the larvae of Drosophila with X-rays at timed stages in their development in much the same manner as that used by Patterson.[1] The larvae for the treatments were in groups less than twenty-four hours old, one to two days, two to three days, three to four days—seven to eight days. Flies showing changes were obtained only in the three-day-old group. The four pairs of chromosomes present in the individuals treated were made to have the following known genes: One sex chromosome had the genes for white eye color, miniature wings and beadex wings, the other X-chromosome was wild type; one second chromosome had the wing gene for curly, its mate was wild type; one third chromosome had the genes for the eye colors scarlet and claret, and gene mutomat causing greatly reduced crossing-over in all chromosomes,

[1] J. T. Patterson, "The Effects of X-rays in Producing Mutation in the Somatic Cells of *Drosophila melanogaster*," SCIENCE, 68: 41–43, 1928.

non-disjunction in one or all chromosomes, etc.; the other chromosome had the gene mutomat.

In the normal course of events, since each known gene has a wild type gene in the chromosome which is its mate, the fly will show only the dominant factors Beadex and Curly, the other factors being completely submerged so far as recognizing their presence is concerned. By producing a change in the wild type gene opposite any of these recessives, however, they may be made to become visible as the character, eye color or wing shape. X-ray is known to be an agent which produces such changes. The treated flies in these experiments were exposed to 2,500 Roentgen units of X-ray.

A single-celled fertilized egg divides into two cells which in turn divide into four cells, etc., each cell containing a complete set of chromosomes similar, so far as we now know, to those which were contained in the original egg. In the course of the cell divisions, however, cells are separated from the rest which have definitive objectives, like the formation of the eye, which on further division form these parts as they are seen in the adult. The time element in this question of this divergence of the cells to form only organs like the eye from those to form other organs may be approached by the use of X-ray and stock like that indicated above. The very fact that such an approach is successful is attendant upon the equally important fact that the theory of the nature of gene action involved has some measure of truth.

The facts of the experiment are as follows. First, all observed changes occurred in the flies treated at three days old. They involved only the eye colors, although changes in wing and sexual characters were equally closely watched. The changes involved all three of the recessive eye colors present. The amount of the organ affected was apparently essentially the same. The gene in the X-chromosome was changed as frequently as those in the third chromosome. Individually considered the changes were as follows: culture 11774 showed a fly with a white V-shaped segment on dorsal side of left eye of twenty-nine cells or ommatidia. A fly from culture 11775 showed two sharply differentiated groups of scarlet cells on the right eye, one group, extending from the anterior margin posteriorly, of twenty-seven ommatidia and another, V-shaped on the ventral side, of thirty-one ommatidia. In the middle portion of the left eye of a fly from 13113 there was an oval spot of thirty-six ommatidia claret in color; 13152 had a fly both eyes of which were affected, the left eye showing ten white ommatidia in a V on the anterioventral edge of the eye, and the right a V of twenty-five ommatidia on the anterior edge; 14146 had a fly whose right eye showed a double V-shaped patch of thirty-two white ommatidia on the ventral edge and another fly whose right eye had an oval spot of claret in the mid-position involving twenty-eight ommatidia. In each case the rest of the eye was wild type, normal in appearance. The line of demarcation between the changed area and the wild type was abrupt. There was no intergrading. The changes affect only the soma of the fly, the germ-cells showing no change.

So far as the time relations are concerned these results agree with those on the white eye factor obtained by Patterson, although the areas affected are slightly larger, due possibly to the fact that our larvae were kept at a lower temperature than his, thus retarding development somewhat.

Considering for a moment the divergent paths which the cells of the developing embryo take, we note certain critical conclusions to be derived from the facts. As the heavy majority of the effects of X-ray in producing changes in eye color change only a small portion of the cells of one eye it follows that the cell or cells forming the right eye are early separated from the cells forming the left eye. From the fact that only a small portion of the eye cells was changed it would seem that at the time of treatment the eye had developed to a number of cells stage, perhaps the thirty-two-celled, since the original one had left the rest of the soma tract. As the frequency of change is greatest where only one area was present on an eye, it would seem that each area represents a separate original cell in which the chromatin material was altered. The fact that flies showing two cell areas affected have these areas of about equal size points strongly to the conclusion that daughter cells of the eye anlage at the same stage of division tend to form an equal proportion of the final organ. The cells forming the eyes on either side of the body appear to be equally susceptible to X-ray effects. It is worthy of note that when two changes in the same organism are seen it is the same gene which is involved.

Genes altering organs so similar as those presumably responsible for the fly's eye color would be expected to travel along the same path in cell division and to be acted upon similarly. All these genes showed changes by X-ray which later developed into areas containing essentially the same number of cells. Thus proof is furnished for the hypothesis that the eye anlage has left the other soma tract four to five cell generations earlier than the time when the X-ray was applied.

The fly larvae exposed to X-ray all carried six marked genes. Since in each case only one of the six genes was affected, the conclusion appears sound

that the X-ray changes were distinctly local in character. It further is clear that the effect in the case of the third chromosome was less than a chromosome in length, since had it not been so both characters scarlet and claret would have appeared as the eye color orange instead of only one of the factors showing.

The data furnish some information on the mechanism by which the gene acts to produce its end product. As it is possible to change the gene in a cell before this gene has manifested its appearance, it is evident that the gene is potentially present in every cell which eventually forms the eye during the entire embryology of the animal, governing its destiny throughout development. The patches of cells which result from the cell in which the mutation was originally brought about are absolutely sharp and distinct from those not so changed. There is no intergrading of the two areas of cells in color. The action of the gene must therefore be within the cell in which it is contained and on no others. On this view the classic reaction, gene $\longrightarrow$ enzyme $\longrightarrow$ end product, must be all cell-contained, or an all-or-none reaction. Such a view presents difficulties which, without any definite proof for the enzyme stage, would seem to be best treated as still a gene-to-end-product reaction taking place within each cell. The facts thus point to the gene as present at each embryological stage in an organ's development and capable of changing this organ at any stage at which the gene itself is changed.

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THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH

THE FUNCTION OF THE FERTILIZATION MEMBRANE IN THE DEVELOPMENT OF THE LARVA OF THE SEA URCHIN

IT is possible to secure fertilization and development of the egg of the sea urchin without the formation of either the fertilization or the hyaline membrane. If unfertilized eggs of *Strongylocentrotus purpuratus* are put into an isosmotic solution of urea for two minutes and then transferred to sea-water containing sperm, the eggs are fertilized, but no membranes of any sort appear on them or subsequently on the blastomeres. Nuclear and cytoplasmic division go on, but the blastomeres are loosely strung together, resembling colonies of yeast cells. The cells usually lie in one—not more than two layers. In twenty-four hours the cells are quite small and have largely lost contact with each other as they lie on the bottom of the dish. The loss of the membrane precursor in the solution of non-electrolyte is irreversible, since if unfertilized eggs, after being kept in the solution of urea, are transferred to sea-water for thirty minutes and then fertilized, they develop exactly as do those eggs which are fertilized immediately after removal from the solution of non-electrolyte. There is no regeneration of membrane precursor.

The addition of Na or K ions does not alter the effect of the solution of non-electrolyte, except that eggs which had been kept in a solution consisting of 50 cc urea M/1 + 1 cc K Cl M/2 before fertilization, during development show ameboid forms. On the other hand, Mg, Ca, or Sr ions when added to the urea solution protect the egg by preventing the outward diffusion of the membrane precursor. If the eggs are kept two minutes in a solution consisting of ½ cc of ⅜ M solution of either $MgCl_2$, $CaCl_2$ or $SrCl_2$ + 50 cc urea M/1, and are then fertilized in sea-water, they form a comparatively inelastic membrane which closely invests the egg. This is membrane formation without elevation. As a result, nuclear division occurs without immediate cytoplasmic division, and the larva is a solid blastula not larger than the unfertilized egg since it is kept from swelling by the closely investing membrane. The addition of 2 cc of a solution of either $MgCl_2$ or $CaCl_2$ results in very nearly complete protection of the eggs, so that when they are fertilized, the fertilization membrane is formed and also elevated as in normal eggs. As a result, division is approximately normal and blastulae with cavities are formed. It is of interest to note that in this reaction Mg ion is equal to Ca ion in protective action, indicating a valence effect. In other physiological processes Ca ion is five to ten times more powerful in toxic or antagonistic action, than Mg ion. Sr ion is approximately twice as effective as either Mg or Ca. This shows a qualitative action in addition to the valence effect.

The results prove that membrane formation is of fundamental importance to the development of organisms consisting of closely associated groups of cells, *i.e.*, metazoa. Furthermore, the results show the difference between membranes which are definite anatomical structures, *i.e.*, the fertilization membranes and plasma membranes. In the typical case of division without membrane formation the cells are well rounded and separate, each cell has a globular form indicating the presence of a plasma membrane, but if the eggs have previously been treated with a solution of urea containing K ion then the plasma membranes are weakened to such an extent that the cells resulting from division may coalesce and show ameboid forms.

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SCIENCE NEWS

Science Service, Washington, D. C.

ADRENALIN DEPOTS UNDER THE SKIN

THE discovery by Dr. A. B. Luckhardt, of the University of Chicago, and Dr. Theodore Koppanyi, of Cornell University Medical College, that the powerful drug adrenalin forms depots when injected under the skin has opened the way for a new method of treatment of certain diseases.

Adrenalin has long been used to raise the blood-pressure, particularly in cases of shock following severe injuries or operations, and because of its relaxing effect on the bronchial muscles it has been used effectively in treating bronchial asthma. However, to produce the desired effect, the adrenalin had to be injected directly into a vein, and for each attack a fresh injection of adrenalin had to be made.

Drs. Luckhardt and Koppanyi have shown in dogs that adrenalin is capable of elevating the blood-pressure even if injected beneath the skin, but they have also discovered the conditions under which the blood-pressure elevating effect of the adrenalin injected beneath the skin may be elicited. They found that about fifteen minutes after the injection of adrenalin underneath the skin, when the injected area was gently massaged, there was at once a very considerable and protracted rise in blood-pressure.

Deep anesthesia militates against the effective elicitation of this response, and this is the reason why previous investigators failed to get blood-pressure rises following adrenalin injections beneath the skin. Drs. Luckhardt and Koppanyi have pointed out that adrenalin injected beneath the skin remains there for some time, and it was even possible to produce blood-pressure rises from massaging such areas which had been injected twenty-four hours before the massage.

Dr. Koppanyi has lately shown that adrenalin injected underneath the skin, with the massage of the injected areas, is just as effective in man as in dogs, and in both cases adrenalin forms a depot underneath the skin, the massage of which results in a blood-pressure rise for over twenty-four hours. It was quite obvious that this observation could be applied in the treatment of various diseases in which the administration of adrenalin is desired. There are quite a number of such conditions, the most important of them being the so-called traumatic shock, which consists of dangerously lowered blood-pressure sometimes following great injuries, operations, etc. A New York surgeon, Dr. Howard Lilienthal, has shown that by using the method of Drs. Luckhardt and Koppanyi, he could restore a patient suffering from traumatic shock.

Bronchial asthma, hives and hay fever also respond very readily to adrenalin. Before the method of Drs. Luckhardt and Koppanyi was known, it was necessary for each attack of these diseases to be checked by a new injection of adrenalin. The method of massaging the injected areas does away with that very often inconvenient procedure, and during the course of a day or two only one adrenalin injection is necessary, and the patient himself may be instructed to massage with a piece of cotton the injected area and thus get the benefit of the full therapeutic effect of adrenalin. Clinical reports have already substantiated the effect of the massage of the adrenalin-injected areas in these diseases.

ANTI-VITAMIN IN CEREALS

OATMEAL and other cereals are suspected of harboring an "anti-vitamin" which, when too much cereal is eaten, can counteract the effects of vitamin D and cause rickets even when an otherwise adequate diet is being eaten.

Most investigators have concluded that vitamin D, which is found in fats, notably cod-liver oil, can prevent rickets, the disease that causes faulty bone formation with the familiar bowed legs and bulging foreheads in infants and children. This disease has been considered due to poor nutrition and principally to a lack of vitamin D in the diet.

However, recent experiments with cereals show that rickets is not purely a result of too little vitamin D, but is primarily due to a lowering of the amount of calcium in the blood, Dr. L. Mirvish, of the University of Cape Town Medical School, has reported to the scientific magazine *Nature*.

The presence of ricket-producing "anti-vitamins" in cereals, chiefly oatmeal and wheat, was first indicated by experiments of Professor Edward Mellanby, of Sheffield University, England, who called the substances "toxamins."

Following this lead, Dr. Mirvish extracted the "anti-vitamin" substance from oatmeal and injected it into rabbits. He found that the calcium in the blood was lowered as a result of these injections. This bore out and explained the work of other investigators who found that rickets can be induced in young animals by feeding them an excess of cereals or by adding extracts of cereals to a diet which did not produce rickets in control animals.

Dr. Mirvish suggests that rickets may prove to be a sign of underactivity of two small glands in the neck, known as the parathyroids, and thought by some authorities to have an important relation to the supply of calcium in the blood. If this is the case, our present conception of the rôle of vitamin D and probably of the other vitamins will have to change very appreciably.

ULTRA-VIOLET WINDOWS

How to let the ultra-violet rays of the sunlight through the window into home and schoolroom was recently discussed by Dr. W. W. Coblentz, physicist of the U. S. Bureau of Standards at Washington, in a report to the Illuminating Engineering Society. He reported his tests upon various window glasses and other materials and suggested that for effective results the material should not transmit less than 45 to 50 per cent. of the ultra-violet rays in the sunlight.

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If only small amounts of the ultra-violet rays penetrate the windows they can not be relied upon to effect cures of rickets, which are possible with large doses of ultra-violet rays as well as with sources of vitamin D. Dr. Coblentz quoted clinical reports that indicated that exposures of five to seven hours each day with light through glass with 25 per cent. transmission would be necessary merely to prevent rickets in a normal, properly fed child, and in view of the fact that such exposures of such lengths are not practicable, he believes that at least 45 to 50 per cent. transmission must be required in specifications. Even with this degree of transmission, the effect would be preventive only and in no sense curative.

Various commercial makes of glasses, after being stabilized by exposure to sunlight, ranged from only one half of one per cent. to 59 per cent. transmission, with four out of nine greater than 40 per cent. Dr. Coblentz used a wave-length of 302 millimicrons as a division point between the ultra-violet rays and the rest of the sunlight.

Tracing cloth, which has been suggested for window material because of a supposed transparency to ultra-violet rays, was found to be actually no more transparent than other fabrics such as nainsook, batiste or balloon cloth. Other studies of fabrics showed that those made of silk and wool yarns compared favorably in transmission of ultra-violet light with cotton, linen and rayon.

Feathers have a fairly high transmission, apparently nature's provision for assuring chickens and other birds their supply of these vital rays. Unlacquered surfaces of metals, aluminum, nickel and chromium are good reflectors of ultra-violet radiation. Linseed oil and nitrocellulose lacquer, especially after drying, are highly opaque to ultra-violet radiation.

THE EUROPEAN PINE-SHOOT MOTH IN FLORIDA

THE European pine-shoot moth, first reported in the United States fifteen years ago, has been discovered in Florida by Perkins Coville, of the U. S. Forest Service. The insect was identified by August Busck, U. S. National Museum specialist on lepidoptera.

Up to this time the European pine-shoot moth has never been recorded south of Washington, D. C. It was first discovered in Long Island, and later spread to the Middle Atlantic States and through the New England States to southern Canada. In the North it seems to confine itself in general to the ornamental trees, and for that reason has not been a serious pest. In parts of Europe, however, it is very serious. It is feared that it may prove very harmful should it get firmly established in the South because of the fact that the long growing season may enable the moth to develop four or five generations a year.

The specimen identified by Mr. Busck was found infesting immature cones taken from a long-leaf pine growing near the Starke, Florida, branch of the Southern Forest Experiment Station. The tree had been used in cross-pollination experiments and removal of pollination bags from the flowers had disclosed the fact that a number of small cones were badly infested.

Mr. Coville describes the larva or caterpillar of the European pine-shoot moth as dark brown, with a deep black head and a black shield on the upper part of the first division of the body behind the head. Allied species are lighter in color. The full-grown larva is two thirds of an inch in length.

The Department of Agriculture has made the request that every one in a position to do so watch for signs of the insect and its damage and send any material showing symptoms resembling the description of the pine-shoot moth infestation to the Bureau of Entomology of that department at Washington, D. C., for examination and identification.

THE HAWAIIAN VOLCANOES

HUALALAI, the Hawaiian volcano for which Dr. T. A. Jaggar has predicted possible eruptive activity within a month, is normally one of the quietest of all volcanoes known to be active. In a statement to *Science Service*, Dr. Harry Washington, of the geophysical laboratory of the Carnegie Institution of Washington, himself a leading authority on the ways of volcanoes, called attention to the fact that during the known history of the Hawaiian Islands, Hualalai has had only one lava flow of major proportions, and that was over a century and a quarter ago, in 1801. Then the lava broke forth from a secondary vent on the side of the mountain and flowed in a widening fan-shaped stream to the sea.

Hualalai lies at a considerable distance from Kilauea, most active and best-known of Hawaii's volcano family. It is situated in the western part of the island of Hawaii, about sixty miles from Kilauea, which stands in the southwestern part. It is about twice as high as Kilauea, rising to an elevation of some 8,200 feet and bearing several well-marked cones on its summit, as well as a number of craters on its slopes.

Mauna Loa, which Dr. Jaggar has warned may join Hualalai and Kilauea in a great triple eruption to relieve the swelling lava tide now rising beneath the island, is the highest of the active volcanoes in the Pacific area, its peak rising to 13,650 feet. This mountain, however, is topped by the towering but extinct Mauna Kea, northeast of it on the same island, which has a height of 13,825 feet.

The action of the Hawaiian volcanoes, Dr. Washington said, is relatively quiet in spite of the massiveness of some of the lava flows. Devastating steam explosions, such as that of Mt. Pelée which almost wiped out the population of Martinique in 1902, are unknown. Explosive activity, filling the air with volcanic ash and hot sand when violent, is limited in Hawaii to a minor rôle.

The main energy of the Hawaii volcanoes is spent in the upwelling of great fountains of lava, which usually burst forth from their sides rather than their tops, and roll in streams toward the sea. These are of course exceedingly destructive, wiping out plantations and villages, but at least they give the inhabitants time to flee to safety.

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of the new Pan-American Institute of Geography and History. This ambitious and important work is expected to be completed by 1935.

The institute, which held its first organization meeting in Mexico City recently, has elected as its active president Dr. Salvador Massip, professor of geography at the University of Cuba. Its honorary presidents are to be Dr. William Bowie, of the U. S. Coast and Geodetic Survey, and Dr. J. Toribio Medina, historian, of Chile.

The institute will study the prehistory of the Americas, the archeology, the history of the Colonial epoch, and events in recent centuries. The geographic studies will include topography, geodesy, cartography, geomorphology, human geography, ethnography and historic, biologic and economic geography. A library of maps, books and other data will be created in the institute's headquarters.

The new institution is to be of international usefulness in providing data on meteorological conditions for Pan-American air routes and in studying disputed boundary problems.

Dr. Bowie outlined the significance of the new organization as follows: "We have heard so much of the application of science to agriculture, industry, commerce and communication, but science can only go so far in bettering conditions of humanity without geographical knowledge. The geographer must aid the chemist, the physicist and the engineer, in efficiently utilizing the resources of nature. Civilization will greatly advance by an early mapping of the world. Maps are still very imperfect. Although much mapping has been done in the United States, only 43 per cent. of the area has been topographically surveyed, and many of these map sheets were inadequately made and do not serve the purposes of agriculture, mining, the development of hydro-electric projects, systems of communication and transmission of power to-day. The Western Hemisphere is new to civilized man, and we must develop and utilize its natural resources as our present needs demand, but without impoverishing the generations to come. In this discreet development and utilization of natural resources, the geographer must play an important part, and the Pan-American Institute of Geography and History can exert a great influence in outlining general geographical problems to be solved, and in disseminating geographical data already existing but not widely known."

ITEMS

THAT undulant fever, one of the newest diseases of man, is widespread throughout the United States, is shown by a survey made by the U. S. Public Health Service. For some time this disease, variously known as Malta, Mediterranean or undulant fever, and acquired from the milk of infected cows or goats or from other infected cattle, was thought to be confined to one or two western states. The survey showed that only West Virginia and Wyoming have not had any cases reported during the five-year period covered by the investigation. The number of cases reported throughout the country has been steadily climbing from 24 in 1925 to 649 in 1928. For 1929 only 366 cases have been reported thus far. Wisconsin, New York, Ohio, Pennsylvania, South Carolina, California, Illinois, Minnesota and Iowa reported the greatest number of cases in 1929. The disease is characterized by long continuation with many periods of apparent recovery and subsequent relapses. High fever with rheumatic and neuralgic pains occur, but the disease is not often fatal.

LEAD, tin and stainless steel offer the most resistance to corrosion when exposed for years to the air, Dr. J. Newton Friend, head of the chemistry department at the Birmingham Technical College, in England, has found in a series of researches upon which he reported at the meeting of the Institute of Metals. A number of cylindrical bars of different metals, each two feet long and an inch in diameter, were exposed on a Birmingham roof for seven years. Various kinds of brass were most corroded, though they passed the test much better than specimens of wrought iron and carbon steels. Aluminum resisted corrosion nearly as well as the lead and tin, though near a body of salt water this would not have been the case.

A LAKE that is deeper than it is wide has recently been investigated by Russian geologists. It lies about 40 kilometers south of the health resort of Nalchik in the North Caucasus, and is known as Cerik-köl, or the Blue Lake. It is only a small body of water, being 235 meters long and 130 meters wide; but it has the surprising depth of 258 meters, with practically vertical walls. Except at its surface, the water temperature remains constant the year round, at about 17 degrees Fahrenheit higher than the average annual temperature of the air. The lake has no surface inlets, not even the smallest of brooks, but a little river flows out of it. The water is presumed to come from subterranean springs. The lake is charged with hydrogen sulphide and also contains gypsum, so that nothing can live in it. There are never any leaves or pieces of driftwood to be found on its surface, which has given rise to the local superstition that nothing can float on its water. The people of the neighboring highlands also have the belief that the mysterious depths of the lake are inhabited by a monster in the form of a bull.

THE art of weaving was known to the Indians who built their mounds in Indiana centuries ago, as it was to their compeers of the Hopewell area in Ohio and to the greatly different Indian civilizations of the Southwest. On opening a leather pouch containing a number of copper bracelets excavated from the mound he is exploring at Winchester, Indiana, F. M. Setzler found three layers of woven cloth. The Indians knew how to make more than one kind of fabric, for part of the material was finely, part coarsely woven. Very little woven work by mound-builders has come down to us, because in the damp earth of the mounds it had no chance to be preserved from decay. The pieces which have been recovered have, without exception, been preserved by contact with copper objects, which formed verdegris, checking the action of fungi and bacteria of decay.

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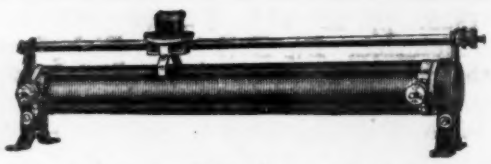

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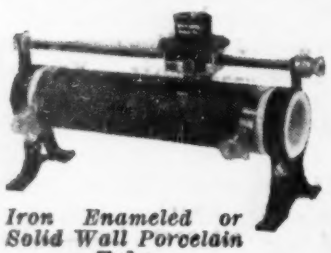

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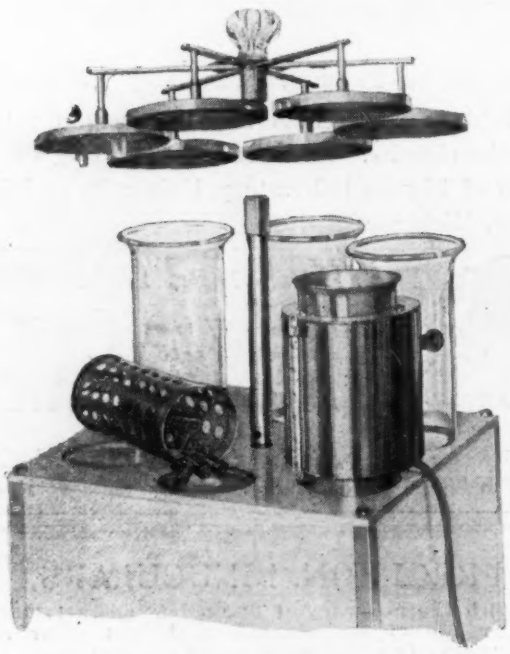

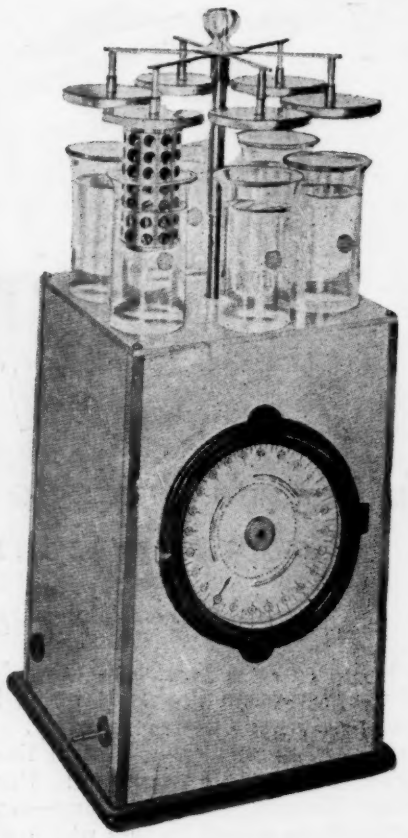

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